THE

ELECTRICAL REVIEW.

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ELECTRICAL REVIEW

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THE

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THE RETARDATION OF TELEPHONIC DEVELOPMENT.

A STATEMENT has been recently made by the National Society of Telephone Employés respecting the action of the company in discharging large numbers of men in view of the expiration of the licence in 1911. It has been alleged that orders for telephones were being refused by the hundred, and that discharges already approached 1,000 hands. Mr. Franklin, the President of the National Telephone Co., in an interview with a Press representative, confirmed the statement that there had been discharges, but doubted their being so numerous as alleged, and pointed out that the company was in no way responsible for the statement. So far from orders being refused by the hundred, the company were undertaking all the orders they could carry out. At present they had a smaller number of unexecuted orders than for many years past. That might be due to bad trade, but it should be clearly understood that the company were not in any way ceasing to give telephone service to those who desired it.

We have frequently had occasion in the past to call attention to the need in telephone business of anticipating future requirements by present outlay. This need for unproductive plant is now sufficiently recognised to make it unnecessary to enlarge upon it, but the fact needs particularly to be borne in mind in considering the position of the telephone in Great Britain in the immediate future. At the end of 1911 the State acquires the property of the company upon terms which are defined by agreement, and the terms are such as to require the company to consider with great care any capital expenditure which they may now undertake. Mr. Franklin stated "it is quite true that there must be some limitation of expenditure in the closing years of the business, because, obviously, the company cannot go on spending capital which would not be productive within the period of the licence, and for which they might only receive a depreciated value. That is really the basis of the whole question." He added that "the company were ready to do anything that was possible to meet the case." They only needed "to be satisfied that any money spent on behalf of the period subsequent to 1911 should be recouped to the company without loss. It would be a great advantage, I think, to the Government if some method could be found, and probably some method may be found."

The position of the company, as stated by Mr. Franklin, is obviously sound, and it may be remarked that, in the main, such a condition of affairs was recognised as possible many years ago, Mr. Forbes having drawn attention to it in the evidence which he gave before one of the early Telephone Committees. The danger to be guarded against is that in the assumed interests of the company as a seller, and the State as a purchaser, the public interests may suffer.

No doubt, as Mr. Franklin says, a way may be found out of the difficulty. The way, we believe, may be the more readily found if it be recognised that this expenditure in advance, if we may so term it, is undertaken by such commercial concerns as telephone companies, simply because it is, in the end, the most economical. It follows that such expenditure cannot be abandoned without the loss of that economy, and such loss would fall, not on the company which expires, but on the State which continues the service. This question of economy is but one item. The question of employment is another, and not only the limited employment which has made itself articulate in the last few days. But above all is the question of the development of the telephone service. We are not in this country such extensive users of the telephone that we can afford to have any retarding influences at work in the next few years. The period is a critical one, and we hope that some means may be found to ensure that the telephone extension work shall be carried on as nearly as possible on the lines which would be followed if no change of ownership were in contemplation.

WANTED: A MINISTER OF COMMERCE.

The Associated Chambers of Commerce at their meeting on Tuesday unanimously expressed their disappointment that his Majesty's Government had as yet taken no action in regard to the appointment of a Ministry of Commerce. We believe that most of our readers—especially that section which is more keenly interested in matters relating to trade—will join with us in sharing that disappointment and regret. Of course we all recognise that whoever may be President at the time, the great bulk of the important duties of the Board of Trade are influenced, and to a large extent controlled, by the permanent officials who have for years been engaged in that department, and are, therefore, thoroughly conversant with the network of considerations that have to be taken into account in connection with its operations, however liable they may be to become entangled in red tape. We have little doubt that a Department of this kind, if it became more susceptible to enlightenment and willing to accept suggestions from those who are in the thick of practical commercial effort, would be quite capable of looking after the trade interests of the country were it not for the fact that it has so many other concerns to handle, concerns which should hardly come under the heading of "trade."

We suppose that it is in regard to matters of broad policy that the President is appointed from the select band of politicians whose shibboleths have found favour with the majority at election times. You may get an admirable chief, who may handle that policy in such a way as to inspire every member of his staff with ideas of the urgent importance of his duties, and, at the same time, inspire confidence among the trading community outside. Mr. Lloyd-George's appointment probably did not inspire such confidence when it was made, but it found full justification in the achievements of the department during his term of office. We all regret his promotion to the office of Chancellor of the Exchequer, much as the honour may have been his due, but here is an illustration of the folly of playing battledore and shuttlecock with a department having to do with trade, which really at bottom is quite as important as national finance, for in it lies the root of our success or failure, and the contentment or unemployment of our peoples. The presidency of such a department ought not to be liable to change every now and then, however clamant other vacant offices may be for our best men. It is of all State positions one which calls for continuity of policy for at any rate a reasonable length of time—we question whether it should change when one party goes out and another comes in, and we condemn altogether the practice under which it is affected when the Cabinet cards are shuffled. We do not mean that it should be a permanent or lifetime appointment, for there would be too great a probability of things getting into a groove. The President should be a man capable of interpreting in the action of his department, the expressed policy of his Government as dictated by the people.

The question might be an interesting one for discussion as to what is the best combination of qualifications necessary in a President of the Board of Trade or a Minister of Commerce. We fail altogether to see what benefit there is in having a politician, whose main characteristics are literary and oratorical abilities, and who knows little about trade and commerce save what he may have picked up on a tour of parts of Africa. However, time will show whether our present fears are justifiable, or whether, by diplomatic handling of labour disagreements, and in other ways, we are to be enabled to avoid costly and injurious struggles, and to thereby benefit our national industries and our international trade.

We observe that one of the speakers at Tuesday's meeting expressed regret that the "apprentices in the Government" were placed at the head of so important a Department as the Board of Trade, and "when they had acquired proficiency were moved on to a higher office." This, we believe, represents the sentiments of a very large percentage of those among us who are engaged in connection with the trade of the kingdom. If for no other reason than that these changes are undesirable, and are disliked by the trading community, there is an urgent demand that the whole subject of a Ministry of Commerce should be properly dealt with. The voice of complaint was quieter when a man of proved ability was in position, showing what could be done. The demand for a Minister on a more settled basis is louder again now that the newly-appointed President is about to serve his apprenticeship when he returns from his honeymoon.

Electricity on American Railways.

Some remarks contained in a paper by Mr. Oliver S. Lyford, before the American Society of Civil Engineers, give one an insight into the progress which is being made in converting steam-operated railways in the States to electrical working.

There are, of course, very many electrical interurban railways in the States which were originally constructed as such, but the converted standard steam railway comes under a different category, and if one may judge by the data given relating to the progress of such work, it does not—taking into account the comparative sizes of the two countries—appear to be making much greater headway than here. Seven large railways are cited as having inaugurated electrical operation, while five others are mentioned as carrying out installations. Of these lines five will be, or are, equipped on the single-phase overhead trolley system, and three of them use 11,000 volts pressure on the trolley line; five railways use the direct-current third-rail system, and others the 600 and 1,200-volt direct-current trolley and three-phase alternating-current systems. The author points out that the last two systems have not met with general favour in the States, where the single-phase system has been selected by most of the railway companies whose decision to electrify has been made since the commercial success of this system has been demonstrated.

In this country the few converted steam lines are all operating under special traffic conditions brought about by the necessity of increasing the number of trains during a given period, and the main line or long-distance traffic problem remains as yet in abeyance. This appears to apply to a large extent to American practice, as no fewer than five of the examples quoted are in connection with tunnels, and several others refer to suburban routes.

In this country the Heysham-Morcambe-Lancaster section of the Midland Railway is the first, and at present the only single-phase standard railway in this country; and in deciding on its equipment the company has been generally credited with a desire to experiment with a view to future possibilities. The trolley line pressure is 6,600 volts, and is similar to that adopted for the London Bridge-Victoria section of the Brighton Railway, on which the work of conversion—so long in accomplishment—is stated to be nearly complete.

With two standard single-phase railways in operation shortly, one may well hope that this system will be able to demonstrate its practicability to the most conservative of English railway officials, on whom American and Continental experience appears to make but little impression.

Competition. We have frequently commented upon the extraordinary differences in prices quoted for electrical work under advertised contracts, and we refer again to the subject, as it is interesting to inquire into the *raison d'être* for such diversity.

It is no question of Free Trade or Protection. Foreigners are not in it, for, in the case before us, it is a London firm which receives tenders for the same work from 16 English houses, the rates varying from £5,261 (accepted) to £9,634. The case we refer to is that of a contract recently settled for wiring the premises of Messrs. Selfridge & Co., in Oxford Street, London.

The competitors for the work were all natives, and included many well-known firms. We need only mention a few names to prove that it was not a contest with outsiders, or with newly established houses, who might take an important contract on low terms for the sake of advertising themselves. On the contrary, we find enormous differences in the prices quoted by such old firms as Rashleigh Phipps and Co. (£9,157), and Foote & Milne (£5,923), or Drake and Gorham (£8,706), and Lund Bros. & Co. (£5,990).

Similar differences are found between the provincial firms who tendered; thus, Blackburn, Starling & Co., of Nottingham, asked £8,074, while the successful competitors, Malcolm & Allan, of Glasgow, were content with £5,261.

Now, how do these wide quotations arise? It must be assumed that all the firms in question know their business, and that they equally well understood the specification of the proposed work; also that they did not tender for the fun of the thing, but on strictly business lines.

It should not be a question between the best workmanship and materials, or the cheap and nasty, for the specification of the firm, or of a competent consulting engineer, would deal with all that.

What about extras? We have heard of such a thing as a contractor looking for his profit from variations in the specified work and additions, but even this is a matter usually dealt with and provided for in properly prepared contracts.

The differences are so great in the tenders we are considering that they cannot be reconciled by the question of what is a fair margin to allow for the contractor's profit. Between £5,261 and £9,634 there is a difference of £4,373, or over 80 per cent., so that if we assume that the successful tender was at a price to leave a reasonable profit, the other competitors must have worked upon principles requiring explanation.

Of course, there are cases where specifications are applied for and a deposit is required from the contractors, returnable in the event of their making a *bonâ fide* tender, and there may be firms who offer on terms which are merely intended for advertising themselves and saving their deposit; but this can hardly be the case with the class of firms in the list we have before us.

It may be that some contractors are manufacturers also of much of the plant used, and that they derive a certain profit from that source, beyond the trade discounts with which their competitors must be content, but such trifling differences would not go far to make up for the great gaps between the respective tenders.

We should have expected that, in the present condition of the trade, tenders for a contract deemed of sufficient importance to attract proposals from so large a number of leading firms, would have been at much closer prices.

Our Competitors. Engineers visiting the Franco-British Exhibition will probably notice the novel systems of gas lighting and heating on view there at present. These systems generally go by some such paradoxical title as "The Safety Gas System," &c.

In these systems the gas so much lauded is generated from petrol vapour, which is mixed with air, the percentage being somewhere about 2 of petrol vapour to 98 per cent. of air. The combustion of this explosive mixture supplies the heat necessary to raise a mantle to a state of incandescence.

Naturally, it being a safety system, and possibly for insurance reasons, the gas generator is placed *outside* the house. Some of these gas generators are worked by a hot-air engine, others by water-power, and others again by gravitation of falling weights. Of course, the winding-up of the weights entails practically *no work at all*, and is no trouble whatever, the law of conservation of energy not coming in here.

Some of these systems claim a saving over coal gas of 20 per cent.

There is in one of the pamphlets the usual comparative table of cost, and electricity per candle-power-hour is given at about four times the actual cost at price per unit quoted.

The Treatment of Iron and Steel in the Electric Furnace.—A maximum consumption of 4 H.P.-hours is quite sufficient to produce in an electric furnace the same results as 1 kg. of coal in a blast furnace, and electrical energy produced by water-power at double the cost per H.P.-year of fuel per ton puts the electric furnace and the blast furnace on equal terms. To make the most of electrically generated heat for metallurgical purposes, the apparatus must fulfil the following fundamental conditions: The point at which the electrical energy is transformed into heat should be surrounded by a neutral atmosphere. The heat should be generated at the highest possible temperature. Contamination of all kinds should be avoided as far as possible, and the furnace should be designed so as to work continuously at full load. Working on these data, a furnace was evolved which is now familiar to all electro-metallurgists under the name of its inventor, Stassano. This will produce steel successfully either from low-grade iron ores or from scrap. The first of these furnaces was erected in 1903 at the Italian Artillery Works in Turin, and was designed for 200 H.P. and operated by three-phase current. Since then, this furnace has been in regular operation, making use of the excess of energy produced by water-power during the high-water season, which lasts for eight months in the year. This results in cheap power for the production of about 2½ tons of steel daily. The second plant was that of Stassano's steel works, at Turin, which is exclusively operated by electricity. Here there are two 100-H.P. furnaces, two 200-H.P. furnaces and two 1,000-H.P. furnaces. The energy is furnished from the public supply mains in the form of three-phase currents at 21,500 volts, and is transformed to suit the requirements of each furnace. The works employs 300 men, and produces chiefly castings of iron and steel. This plant also utilises the excess of energy produced from water-power during the high-water season. The production is arranged, therefore, in such a way that during these eight months one of the two 1,000-H.P. furnaces is in operation, while in the four remaining months this is idle. Some months ago a 250-H.P. furnace of the rotary type was erected at the Bonner Fräser Fabric, in Bonn, Germany, and set in continuous operation to produce mild and special steel castings. This is fed by three-phase currents from the Berggeist-Brühl Electricity Works, which are steam-driven. The voltage supplied is 5,500 volts, and is transformed down to 100 volts between phases for use in the furnace. In a recent article in the *E.M.I.*, Vol. VI, No. 8, the inventor has given much valuable information regarding the composition, the materials and products of these furnaces. From these data it is quite clear that iron and steel can be produced directly from even low-grade ores, provided cheap electrical energy is available or fuel scarce. Although no such furnace is in continuous operation for this purpose exclusively, it is now an established fact that electric smelting can compete with the blast furnace under suitable conditions.

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THE BRITISH ASSOCIATION MEETING AT DUBLIN.

(*Continued from page* 413.)

Tuesday, September 8th, was not electrical in Section G, but the "Laws of Flight," a paper by Mr. F. W. Lanchester, drew the largest gathering that the Engineering School at Trinity College held during the whole of the meetings. The subject was one of absorbing interest from both the popular and the engineering points of view, and Londoners no doubt began to wonder what would happen when surface contact and conduit systems ceased from troubling and motor omnibuses began to fly. It was quite a depressing fall that brought us on Wednesday down to such a prosaic subject as that of "Urban and Suburban Transit and Methods of Railless Traction," introduced in a lengthy paper read by Mr. F. Douglas Fox, which is dealt with in the following pages of the Electrical Review. Some further papers of electrical interest were brought before Section "A" on Tuesday and Wednesday, and the titles of these we include in the complete list which is given below.

In the Chemical Section peat came in for a good deal of discussion. Dr. Woltereek led off with a paper in which he described a number of experiments which had led him to conclude that a part of the ammonia, obtained when air and steam are led over peat in an iron retort at about 450°, is derived from the atmospheric nitrogen. He also showed some slides of plant which he had erected to try the process on a small scale. In the discussion, Prof. Ryan, Mr. Rigby, Dr. F. M. Perkin, and others pointed out that the ammonium sulphate obtained was never equivalent to the ammonia in the peat, only about 60-70 per cent. being recovered, and hence there was no justification for calling in the atmospheric nitrogen. As to the possibility of using the process on the technical scale, it was pointed out that there is not sufficient—barely any—margin between the price of ammonium sulphate and the cost of peat and fuel for raising the necessary steam. Moreover, the waste gases contain 6-8 per cent. carbon monoxide, too small a proportion to burn, but much too large in the case of such a poisonous gas to turn adrift. It was suggested that peat might be used in the manufacture of producer gas, when it would pay to collect ammonium sulphate as a by-product. Mr. Eller said that peat works were running successfully in Sweden, and, he thought, should do so, if on a sufficiently large scale, also in Ireland. Sir James Dewar thought it would be well to put aside the whole idea of making ammonia from atmospheric nitrogen until some change took place in economic conditions.

Mention ought also to be made of a very interesting discussion introduced in the Economic Science Section, by Prof. W. J. Ashley, Dean of the Faculty of Commerce at the University of Birmingham, on the subject of "Instruction in Universities as a preparation for Commerce and Business Life."

It now only remains to add that next year's meeting of the Association is to be held at Winnipeg from August 25th to September 1st, with Prof. J. J. Thomson as president. Admirable arrangements are being made for a number of those present to visit the farther western parts of Canada. In 1910 Sheffield is to be the meeting place, Portsmouth at present being thought of as the rendezvous for 1911.

List of Papers, &c.

The following is a complete list of all papers either directly or indirectly of electrical interest, with a letter indicating the Section in which they were read. "A" means Mathematical and Physical Science Section; B, Chemistry; F, Economic Science and Statistics; G, Engineering; I, Physiology; K, Botany; L, Educational.

Report of Electrical Standards Committee (A).
Gaseous Explosions, Report of Committee, Discussion (G).
Sir W. Ramsay on "Do the Radio-Active Gases (emanations) Belong to the Argon Series?" (A).
W. Makower on "The Number and Absorption of the β Particles Emitted by Radium." (A).
Prof. E. Rutherford on "The Scintillations of Zinc Sulphide.' (A).
Prof. J. A. McClelland, "Secondary Radiation" (A).
Presidential address of Prof. F. S. Kipping to Chemical Section (B).
F. O. Lyons, "Assessment of Railways for Local Taxation" (F).
Sir Oliver Lodge on "Electricity in Agriculture" (F).
Presidential address by Dugald Clerk (G).
Gerald Stoney on "Recent Advances in Steam Turbines" (G).
Prof. Bose, "The Mechanical and Electrical Responses of Plants" (K).
Presidential address by Prof. L. C. Miall to Section L.
Sir J. Dewar on "The Rate of Production of Helium from Radium."
Report of Committee on "Electrical Phenomena and Metabolism of Arum Spadices" (I).
Report on "Experimental Science Studies in Elementary Schools," by W. M. Heller (L).
Dr. J. W. Nicholson, "The Self-Inductance of two Parallel Wires" (A).
Sir O. Lodge and Benjamin Davies on "The Measurement of Large Inductances containing Iron" (A).
Dr. J. A. Harker and F. P. Sexton on "The Effect of Pressure on the Boiling Point of Sulphur" (A).
Prof. E. T. Whittaker on "The Extension of Optical Ideas to the General Electro-Magnetic Field" (A).
Dr. R. T. Glazebrook on "The Photometric Standard of the National Physical Laboratory" (A).
John Brown on "The Dry Daniell Cell" (A).
Sir Wm. Ramsay on "The Inactive Gases" (B).
Prof. W. N. Hartley on "Lithium in Radio-Active Minerals" (B).
Dr. K. Onnes (communicated by Sir J. Dewar) on "The Liquefaction of Helium" (B).
Sir J. Dewar on "Anticipations and Experiments on the Liquefaction of Helium" (B).
Dr. H. J. S. Sand on "Demonstration on the Rapid Electro-Analytical Separation of Metals" (B).
W. E. Hughes and Dr. F. M. Perkin on "Studies on the Electro-Deposition of Metals" (B).
Capt. H. R Sankey on "The Utilisation of Peat for Making Gas or Charcoal" (G).
J. Emerson Dowson on "Producer Gas" (G).
P. W. Robson on "Suction Gas Producers" (G).
W. Rosenhain on "The Study of Breakages" (G).
E. Wilson on "The Electrical Conductivity of Certain Light Aluminium Alloys, as Affected by Exposure to London Atmosphere" (G).
Prof. A. W. Conway on "Distribution of Electricity on a Moving Sphere" (A).
H. H. Poole on "A Determination of the Rate of Evolution of Heat by Pitch-Blende" (A).
T. Royds on "The Grating Spectrum of the Radium Emanation" (A).
Dr. W. G. Duffield, "Photographs of Arc Spectra of Metals Under Pressure" (A).
Dr. G. A. Hemsalech on "New Methods of Obtaining the Spectra of Flames" (A).
Discussion on Peat in Chemistry Section (B). H. C. Woltereck on "The Production of Ammonia from Atmospheric Nitrogen by means of Peat."
Discussion on "Instruction in Universities as a Preparation for Commerce and Business Life," opened by Prof. Ashley, of Birmingham University (F).
F. H. Royce on "The Causes of Wear in Motor Vehicle Machinery', (G).
M. F. Fitzgerald and J. Brown on "Experiments on Rotating Disks" (G).
F. Douglas Fox on "Urban and Suburban Transit and Methods of Railless Traction" (G).
W. Thompson on "The Velocity of the Reducing Action of Electrolytic Hydrogen on Arsenious and Arsenic Acids when Liberated from the Surface of Different Elements" (A).

A Comparison of Existing Methods of Street Transport.

This is not the title of the paper read by Mr. F. Douglas Fox before Section G of the British Association on September 9th, but it is shorter, and perhaps more to the point.

We were led to expect a paper chiefly descriptive of the railless electric traction system, or the trackless trolley, which is entering upon the "boom" stage of its existence, but the paper dealt very briefly with that system, and was concerned throughout the greater part of its length with the commercial shortcomings of electric tramways. We suppose that the author's purpose was served just as well in this way, as the net result is that the trackless trolley system is thrown up in bold relief against the dark background prepared for it.

Considered as a whole, the paper is a good one, and we have no desire to pick holes in it, but before proceeding to any critical examination, we will give its salient features in the form of an abstract.

The scope of the paper is limited to a discussion of transportation systems for the streets of towns of moderate size.

The question whether traction with or without rails is the better, has not yet been solved by experience, but the principal technical points involved in the problem are simplicity, capacity, speed, acceleration and comfort; while the commercial points are moderate capital expenditure and operating costs, including ample depreciation.

The cost of constructing tramways in Great Britain has been increasing steadily for years, and an analysis of results obtained on municipal tramways shows, on the whole, unprofitable business.

A mechanical 'bus installation costs less than half that of an electric tramway, and, although the running costs are greater, when everything is taken into consideration, the total costs of tramway and petrol 'buses are about equal.

Some 65 millions sterling are embarked in electric tramways, and it is useless to suppose that any motor-'bus service can displace these tramways, so the 'buses must look for occupation amidst the less remunerative, because less densely populated, districts.

A railway is an unnatural adjunct of a city street, interfering with a dense heterogeneous traffic during construction, operation and repair; but a rail car is superior in comfort and capacity, at present, to a railless 'bus.

The available statistics of motor-'bus services are as yet little more than estimates, but the following table is put forward as the general basis of further calculations:—

TABLE I.

	Average minimum remunerative revenue.	Actual average revenue.
71 Corporation tramways	9·96d. per car-mile	10·52d.
Petrol 'bus	11·7d. „	—
Electrobus	10·25d. „	—
Trackless trolley ...	7d. to 9d. „	—

The following points in favour of the electrobus system were fully established by an examination into the London business after six months' running:—

1. The vehicle weighs 7½ tons fully loaded, and can run 40 miles on one charge without distressing the batteries.
2. The energy consumption upon London streets does not exceed that of the average electric tramcar.
3. Depreciation of parts is moderate compared with a petrol 'bus.
4. Steep grades present no difficulty, and do not appear to distress the battery.

The makers of the batteries are said to be quite satisfied with their contract to supply and maintain the batteries at the rate of 2d. per car-mile.

It is acknowledged that the operation of this service up to the time of the investigation was more or less experimental, but sufficient data have been accumulated to make possible the production of an estimate for a service maintained by 100 'buses, and the author considers that this "fleet" could be run for 9½d. per car-mile, including maintenance and depreciation. The capital expenditure is assumed at £125,000, and interest on this at 6 per cent. equals 0·75d. per car-mile on the estimated annual mileage of 2,400,000, making a total cost per car-mile of 10·25d.

Coming now to the trackless trolley system, it is stated that the first Continental line was built in 1901, and that there are now in operation seven in Germany, one in France, and three in Italy.

The Mülhausen Corporation appointed a Commission to report on three proposals:—

1. A very cheap form of electric tramway.
2. A service of benzine 'buses.
3. A railless traction line.

And the following table presents a digest of the estimates:—

TABLE II.

	Tramway.	Benzine 'bus.	Trackless trolley.
Total cost	£62,530	£23,581	£25,050
Cost per route mile ...	£9,260	£3,500	£3,700
Total operating costs, including repairs, renewals, depreciation and 4 per cent. interest on capital ...	7·30d.	9·45d.	5·13d.

It is to be remembered, however, that the capacity of the tramcar was to be considerably greater than that of the other two vehicles.

These figures are useful for comparison between themselves, but must not be applied to other than German conditions, though the author proceeds to state that such a trackless system would pay in England with the smallest revenue earned by any English tramway, even after allowing for the higher rate of wages in this country.

The adoption of the electrobus or the trackless trolley depends upon whether overhead wires are allowed, and whether the traffic will be heavy enough to cover the extra cost of batteries, but in any case the two systems should be viewed as complementary, not as antagonistic.

An analysis of municipal tramway statistics shows how this system of transportation has overstepped the limit of commercial soundness:—

TABLE III.

Capital expenditure upon 71 undertakings ...		£27,213,674
Gross income, 1907		6,361,860
Operating costs, 1907		3,833,370
Net income, 1907		2,528,160
By Deductions—		
Interest	£801,906	
Sinking fund	641,074	
Income-tax	39,012	
Depreciation	528,733	
Sundries	176,753	2,187,478
Net surplus...		£340,682

Of these 71 undertakings 20 showed deficits, 36 showed surpluses and 15 showed an even balance.

TABLE IV.

	Percentage of Net income.	Percentage of capital expenditure.
Interest	31·90	2·945
Sinking fund	25·55	2·355
Income tax	1·55	0·143
Depreciation	20 60	1·945
Sundries	7·00	0·650
	86·60	8·038

The surpluses of the 36 towns were disposed of as follows:—

TABLE V.

	Percentage of Net income.	Percentage of capital expenditure.
Carried forward	2·25	0·209
Reserve	2 10	0·195
Relief of rates	13·27	1·230

and the entire surplus of 71 undertakings is equal to about 1½ per cent. on the capital cost, but on 30 tramways, totalling more than 500 miles of single track, no allowance was made for depreciation.

The size of a town does not always govern the financial success of its tramways, although the larger usually pay.

The capital expenditure of 55 undertakings, having combined traction and lighting stations, varies from £10,630 to £37,210 per route mile, and from £7,516 to £20,728 per mile of single track; and in 16 towns having separate stations the figures range from £17,750 to £46,300 per route mile, and from £10,888 to £23,514 per single mile. The great variation is chiefly due to permanent way, road widenings, and legal charges.

The "route length factor" is the miles of route per 1,000 head of population, and the table gives approximate averages for British tramways. As a rule, this factor is in inverse proportion to the size of the town.

TABLE VI.

Population.	Route length factor.	Population.	Route length factor.
20,000 ...	0·180 to 0·220	120,000 ...	0·113 to 0·139
40,000 ...	0·162 „ 0·198	140,000 ...	0·105 „ 0·129
60,000 ...	0·147 „ 0·179	160,000 ...	0 099 „ 0·121
80,000 ...	0·134 „ 0·170	180,000 ...	0 094 „ 0·155
100,000 ...	0·123 „ 0·150	200,000 ...	0·090 „ 0·110

The next table gives a rough approximation to the average journeys per head per annum for towns of various sizes.

TABLE VII.

Population.	Riding habit.	Population.	Riding habit.
20,000	50	120,000	89
40,000	65	140,000	93
60,000	75	160,000	95
80,000	81	180,000	97½
100,000	86	200,000	100

And for each 100,000 more add 12½.

That this table cannot be applied to a new case indiscriminately is shown by considering the examples of Lincoln, population 55,000, riding habit, 27; Maidstone, population 13,000, riding habit, 91; but Glasgow, population 1,000,000, riding habit 213, coincides nearly with the author's figures.

The average fare per mile ranges from 0·36d. to 1·0d., this variation having no relation to costs of construction or of operation, and probably £100,000 per annum is given away to the general travelling public because of the inadequate tariffs in force. Units per car-mile vary from 0·88 at Keighley to 2·08 at Burnley; cost per unit varies from 0·32 at Leeds to 2·14 at Lowestoft; cost of energy per car-mile varies from 0·37 at Glasgow to 3·032 at Burnley.

We transpose the following sentence from the beginning to the end of the paper as being the more fitting position, in view of the author's probable design.

"The peculiar facility with which by the trackless trolley system both passengers and goods traffic can be handled over the same line, renders it probably the most economical system of highway transportation yet devised."

If we felt at this time that the universal system of street traction required any further assistance on our part to keep it on its legs, we should make a great deal of the very obvious defect which stares out of Mr. Fox's paper. While flaying the very bones out of our municipal tramways with the lash of a thousand figures, none of which we are prepared to dispute, he holds before us as a means of salvation an extremely meagre array of data, which appears to have been built up by faith alone.

We have never hesitated to announce our antipathy to many phases of municipal trading, and we are only too well aware how unsound are the majority of our municipal tramways when dissected by the knife of the financier, and, Heaven knows, we are none too sanguine of the commercial prosperity of tramways owned by many a public company,

but we are not at all prepared upon the evidence put forward by Mr. Fox to endorse his opinion that our towns, however large, would have been as well served by electro-buses or by trackless trolley cars. Nor do we find ourselves agreeing with his statement that rails (as laid in these islands) are "an unnatural adjunct of a street," or that the cars which run on them "interfere with the dense heterogeneous traffic."

They are no more unnatural than the pillar box at the street corner or the clothes which the author himself wears, although we admit that both may be unnatural enough when referred to some earlier standard. The cars, moreover, do not interfere with, but are part of the street traffic, and on that account interference is a mutual and indistinguishable factor. We might suggest, too, that the exchange of one tramcar holding 50 people, for two 'buses of any variety holding 25 people apiece, would not lessen this mutual interference.

Mr. Fox's paper is valuable for two reasons, and it must have cost him a great deal of labour and some thought. First, it will focus the minds of those who have not lost the requisite adaptability, on the fact that our tramways, having been hampered from all sorts of reasons with a great deal of useless capital, are being brought year by year to a point at which they will not be able to pay their capital charges. Probably that state of affairs is entirely unavoidable, and it is a matter of vital importance to all ratepayers that the causes should be not only diagnosed but cut out. Chief among them is that canker of cut-throat fares which is sapping the good life from every system of transport in the country, down to the donkey on the sands.

Secondly, Mr. Fox's paper ought to make us speculate upon the possibilities which lie before the perfected railless vehicle. Every system has its field, and we have not been behind-hand in expressing our belief that independent or semi-independent mechanically-propelled vehicles will prove to be of the greatest value as pioneers to the cheaper forms of light railway, which themselves may be superseded in turn by a fully developed electric tramway or railway service.

Battery traction has been given so many chances under such widely differing conditions that we candidly admit our scepticism as to the success of the electrobus on anything like a universal scale; nor do we think it so suitable for suburban or isolated country districts, as, for instance, some form of petrol, or petrol-electric vehicle having no batteries.

Nothing whatever will be gained, and much may be lost to the Railless Traction Syndicate, by reaching up to hit at electric tramways. All the energy which they might put into that courageous but unprofitable sally would be much better placed in the fight which they must have with more or less kindred systems. They should remember that Mr. Fox's statement that the trackless trolley system has a *peculiar facility* for handling both passengers and goods over the same line is incorrect, inasmuch as this facility is shared by every system of transport that we know, therefore his conclusion that the system is *probably* the most economical yet devised is worthless.

They should remember also that powers to open up the public and private roads for the purpose of planting poles, laying feeder cables, and erecting switch pillars, all of which they must expect to do in England, are not going to be obtained for nothing, or without invoking the aid of Parliament and the local authorities.

The only material thing which is not common to railed and railless street traction is the permanent way, and we shall expect the test of time to inform us more accurately than anyone can do after the experience of comparative estimates compiled by a Commission of German Town Councillors, as to the difference which the absence of an approximately ideal rolling surface makes to a number of trolley 'buses running over unprepared country roads of average contour.

We shall expect to hear that the depreciation of overhead equipment and rolling stock is largely in excess of that on an average tramway and the permissible speeds will be less, and the standard of comfort will be lower.

In spite of what may seem to Mr. Fox and his colleagues ill humour on our part, we wish to express again, and to express emphatically, that we look forward to the day when country roads at least will be equipped with trolley wires or their equivalent, and every farmer, large or small, can reach his market at a fraction of the cost, and in a tithe of the time, to which he is accustomed now.

The Production of Cheap Power by Suction Gas Plants.

By Phillip W. Robson.

(Abstract of paper read in Section G, September 7th, 1908.)

In the two years which have intervened since Prof. Dalby first described the suction gas producer before this Association, the demand for such apparatus has shown a steady and continuous growth both in this country and abroad.

There are several reasons for this, the chief of which undoubtedly is that the modern gas engine and suction producer can, in fact, give power to small users and to large users for factory and electric driving more cheaply than it can possibly be obtained by other means. To illustrate this point I have selected three typical cases where the load demand and general requirements are widely different, and in each case the figures given represent average ascertained costs over at least a 12 months' period of working.

Ascertained Total Power Costs with National Gas Engines.

——	Case A. Cement works.	Case B. Weaving shed.	Case C. Small factory.
Size of installation in B.H.P.	450·0	300·0	20·0
Average working load, B.H.P.	360·0	220·0	7·8
Total B.H.P.-hours per annum	2,726,000	610,500	21,200
Initial total cost of installation (including foundations)	£4,230	£2,640	£250
Total annual charges:	£ s. d.	£ s. d.	£ s. d.
Interest and depreciation ...	423 0 0	264 0 0	25 0 0
Repairs and sundries ...	50 0 0	30 0 0	3 10 0
Fuel	1,298 4 8	135 4 2	15 11 0
Oil	135 3 10	10 0 0	2 0 0
Water (taken from canal in cases A and B)	—	—	7 5 0
Attendance, &c.	423 17 4	135 0 0	12 10 0
Total	2,330 5 10	574 4 2	65 16 0
Total cost per B.H.P.-hour ...	0·205d.	0·225d.	0·745d.
*Equivalent cost per Board of Trade unit	0·245d.	0·27d.	0·79d.

* This means that if current were delivered from a public supply to a motor of 90 per cent. efficiency in cases A and B, and a motor of 80 per cent. in case C, the rate of charges for such current would have to be those stated to give the equivalent cost per B.H.P.-hour also mentioned above. If, however, the standing charges in respect of the motors and electrical installation generally are added, this rate would have to be greatly reduced to equal the gas engine installation in economy.

The significance of the above figures will be appreciated from the fact that if in case A current was taken from a public supply at ½d. per unit, the total cost of the same would be £4,708 per annum. As the actual working costs with suction gas are £1,907, the difference between the latter and the cost of electricity at the assumed low rate of ½d. per unit represents a saving of £2,801 per annum in favour of the gas power installation. This saving would entirely defray the initial total cost of the latter in a little over 18 months.

Nor can it be said that this economy has been obtained at the sacrifice of reliability, for, in the weaving shed referred to, the engine has been started up punctually every morning without fail, and the only stoppage in 12 months was that due on one occasion to a heated connecting rod brass. In the case of the cement works, rotary kilns are being operated, and the engines are regularly run for periods of from six weeks to two months night and day without stoppage. As I have said, these cases are typical.

Up to the present, for reasons which will be explained later, suction producers have only been made to work on a commercial scale with non-bituminous fuels, such as anthracite and coke, both of which are easily obtainable in the industrial centres of the kingdom. In England, Welsh anthracite was obtainable until two years ago for about 20s. per ton, at which figure there was no difficulty in obtaining the much advertised "10 B.H.P. for 1d." in fuel cost. With the rise in the price of anthracite, gas plant makers adapted their apparatus to work with gas coke, which can be bought at from 10s. to 15s. per ton, and as the consumption of such coke in a well-designed producer need not exceed 25 per cent. more than anthracite for the same power, it will be seen that it is in any case more economical to use it. In Scotland, suitable anthracite can be obtained at from 10s. to 15s. per ton, and the local supplies of anthracite in most of our colonies and in France and Spain are now being successfully used for suction producers, whilst in other countries charcoal is plentiful and comparatively cheap. Speaking generally, therefore, the fuel problem both at home and abroad now presents little difficulty to those who have carefully studied the matter.

In order to get the highest working efficiency, the steam supply should be regulated so that the temperature of the fire in the producer is kept as high as possible without making excessive clinker, seeing that a richer gas thereby results, and the reversible re-

actions tending to the destruction of carbon monoxide are avoided. Prof. Bone and Mr. Wheeler recently demonstrated the truth of this statement in an exhaustive series of experiments on a Mond producer. The fuel used contained 78 per cent. of carbon, and by varying the amount of steam in the air blast from 0·45 lb. to 1·55 lb. of steam per pound of coal gasified, the efficiency of the producer, including the steam for blowing engine, was found to fall from 77·8 to 66·5 per cent. Similar comparative results may be expected from a suction producer, and this drop of efficiency would appear to be due chiefly to the influence of the reversible reactions referred to. The efficiency of a good suction producer varies from 85 to 90 per cent., according to the conditions under which it is worked.

The importance of properly proportioning the steam supply will be appreciated; otherwise, the best results cannot be obtained, and this is one of the points to which further attention might with advantage be given by gas plant designers. Given a properly designed producer, however, the conditions of highest efficiency can be automatically and continuously obtained, without the slightest trouble, week in and week out, whilst the plant is being worked by an ordinary attendant.

In all suction producers directly connected to the engine and automatically regulated thereby, successful working depends also upon the absence of any serious restriction to the flow of gas from the furnace to the engine cylinder. If there is a restriction for any reason, the weight of charge drawn into the working cylinder of the engine is reduced, and a loss of power results which may make all the difference between success and failure.

The very simple form of generator and scrubber in the ordinary suction plant using non-bituminous fuel, makes it possible to avoid undue restriction; even when gas coke or poor anthracite is used, each of which yields a certain amount of tarry matter and consequently requires the addition of a suitable tar extractor to the scrubber, the suction pressure can be kept sufficiently low to prevent the volume of charge becoming unduly diminished.

From these remarks it will be understood that simplicity in all directions is the essential condition for successfully working any producer by the suction effect of the engine, and, this being so, the difficulty of treating bituminous fuels in the simple type of producer will be appreciated. Bituminous fuels contain upwards of 30 per cent. of volatile matter, which distils off at such temperatures as are found in the upper part of a suction producer; thus, if the coal container were charged with this fuel whilst the producer was at work, a considerable proportion of the volatiles would be distilled and would pass away along with the gas made in the lower part of the furnace before this fresh fuel reached the active zone of combustion. Now, of these volatiles, 6 per cent. and upwards is tarry matter, which condenses out as the temperature of the gas is lowered in the scrubber and gas mains. These latter would quickly become clogged up, and, in addition, so large a proportion of tar would be carried forward to the engine that the successful working of the latter would be vitiated. It is this tar difficulty which is the chief trouble to be dealt with in making a successful suction producer to work with bituminous fuels, for the addition of extra cleaning apparatus to extract the tar in a sufficient degree would necessarily have the effect of greatly increasing frictional resistance to the passage of the gas from the generator to the engine, and would otherwise destroy that simplicity of arrangement which we have seen to be essential.

Attention has naturally been turned, therefore, to various methods by which the tar trouble can be eliminated, with the hope that it might prove possible to transform the condensable tarry vapours into fixed gases in the generator, so that the difficulty of tar extraction and additional cleansing apparatus generally could not arise at all. It is, however extremely doubtful whether a successful solution of the difficulty will be arrived at by these methods.

There would seem to be no reason why the furnace of the producer should not be devised in such a way that the volatiles are absolutely burnt out after being distilled, the heat of this combustion being afterwards recovered by the decomposition of steam. In practice a gas of about 150 B.TH.U. calorific value might reasonably be expected, which is quite suitable for engine work. By such a method the tar would undoubtedly be eliminated, whilst the efficiency of the system would be high. There are several designers at work on producers of this character, and when the proper proportions and other practical details are understood, a considerable measure of success may be hoped for; the simplicity of the cooling and scrubbing arrangements under this system gives good promise of the feasibility of evolving a practical suction plant for use with bituminous fuels. The ordinary plant, however, for gas coke or anthracite may still be expected to hold the field for units up to 100 B.H.P.

Reviewing the present position of suction plant combinations as a means of deriving cheap power, I think it is now generally admitted by those who have looked carefully into the matter that the claims made in respect of their convenience, economy and reliability are well founded. It is becoming increasingly recognised by leading electrical engineers that it is exceedingly difficult, and in many cases impossible, to supply current for power purposes from central stations at rates sufficiently low to favourably compete with the cost to the consumer if he generates his own power. In a comprehensive paper read before the Institution of Electrical Engineers, Mr. Snell has emphasised the present inability of most electricity undertakings to meet a large demand for power at sufficiently low rates to hold their own with users' own plants, and I understand his remedy to mean the remodelling of central power stations, the writing down of the capital expenditure already incurred in connection with them, and the elimination of independent electricity stations in the smaller towns in favour of a central installation supplying a group of towns.

So far as the British Isles are concerned, all power must be derived from coal, which is almost our only source of energy at the present time. The fundamental problem, therefore, is to utilise the heat energy of the fuel as efficiently as possible at each point of application, and when power users, both small and large, have at their hand in suction gas plant installations a simple apparatus for so doing, which is practically as efficient as the largest central station plant, the latter is at a great disadvantage when heavy distribution charges have to be added to the cost of power production at the station. With the foregoing important considerations underlying all problems of power supply from a central source, there would appear to be no pressing need for heavy expenditure on the part of public bodies in order to provide cheap power for manufacturers. I venture to suggest that these facts are of special importance in the case of our municipalities which already have to meet such numerously heavy and greatly increasing monetary demands in connection with those objects and undertakings for which in any case they must accept responsibility.

On the Measurement of large Inductances containing Iron.

By Sir Oliver Lodge, F.R.S., and Benjamin Davies.

Section A.—Abstract.

We have had occasion lately to measure large inductances, up to and above 100 henries, with core consisting of sub-divided iron in a nearly closed circuit, as used for certain telegraphic purposes with very weak currents. Since the inductance may vary rapidly with strength of current, it is necessary in any measurement to imitate the conditions of practice, and to determine the inductance as a function of current under those conditions. To this end we have designed a maximum-amplitude galvanometer, consisting of a well-damped coil moving *dead beat* in a strong magnetic field, and attached to a mirror so that the amplitude of its excursion can be observed. It can subsequently be calibrated by means of a steady current giving the same deflection. The inductance to be measured is connected up in series with the galvanometer, and with a specially designed alternator of small power and known frequency $p/2\pi$, giving a sinuous or simple harmonic current. A switch allows the inductance to be suddenly replaced by a non-inductive adjustable resistance R′; and when under these conditions the same oscillation is produced in both cases, then the self-induction is equal to that equivalent resistance divided by the frequency constant; or $L = R'/p$. The strength of the current involved in this measurement is known by imitating the deflection with a known steady current; and the main measurement consists simply in observing the deflection caused by the sine-alternator, at a measured frequency, either with the inductance, or with the adjustable non-inductive resistance, indiscriminately. It is to be understood that the ohmic resistance of the wire wound on the self-induction is low. If not, a correction must be applied for that, which is easily done, since $\sqrt{(R^2 + p^2 L^2)} = R'$.

The following empirical expression is found able to give the self-induction of a nearly closed magnetic circuit excited only by very weak currents, since for such currents it is found to be practically constant—

$$L = \frac{k\, n^a}{(G + g)^b},$$

where n is the number of turns, G the width of the air-gap in millimetres, and the other quantities are constants to be determined by experiment: though a will naturally be nearly 2. In an actual case of a nearly closed magnetic circuit the following values were found—

$$a = 1{\cdot}99; \quad b = 0{\cdot}47;$$
$$k = 18; \text{ and } g = 0{\cdot}1.$$

Results.

The result of this method of measurement applied to inductance coils of this type shows (1) that measurements based on a determination of the square root of mean square of current would serve fairly well for low magnetising forces; (2) that the self-inductance of such coils is for weak currents nearly independent of frequency, or, say, for all frequencies up to about 20 per second, when the magnetising force does not exceed ·04 C.G.S.; (3) that the self-inductance of a nearly closed magnetic circuit is a definite and dependable function of the width of the air-gap for moderate currents and frequencies.

Results of some Physical Observations taken on the National Antarctic Expedition, 1902-1904.

By L. C. Bernacchi.

Section A.—Abstract.

The "winter quarters" of the ship *Discovery* were situated in lat. 77° 50′ 45″ S., long. 166° 44′ 30″ E. The magnetic and other physical observations conducted on the shore close to the ship extended over a period of nearly two years.

The *Discovery* "winter quarters" were to the south-east of the south magnetic pole, the mean absolute declination being about 152° E. The regular diurnal variation of declination is five or six times as large as that at Kew. The extreme positions are reached at about 9 a.m. and 7 p.m., and are totally different to those customary. The horizontal force at "winter quarters" is about a third of that at Kew, but the range of the diurnal

inequality about 50 per cent. greater than at Kew. The most striking peculiarity in the diurnal inequality in all the elements is the large size of the fundamental or 24-hour Fourier "wave" as compared to the harmonics of shorter period.

In order to determine the position of the south magnetic pole by means of all the declination observations taken at "winter quarters," sledge journeys, and at sea, the results have been plotted, and the direction of the magnetic meridian as indicated by the observations extended towards the magnetic pole. These lines of direction intersect within a space triangular in form. The radius of the circle inscribed in the triangle measures about 38 geographical miles; the centre of the circle indicates the probable position of the pole, and is in lat. 72° 50′ S., long. 156° 20′ E.

All the inclination results were plotted on a chart and lines of equal inclination drawn, from which the probable position of the pole was indicated to be in lat. 72° 52′ S., long. 156° 30′ E. The agreement between this position and that determined by the declination results is remarkable, and may be considered as corroboration of the results.

The mean of the two positions, viz., lat. 72° 51′ S., long. 156° 25′ E., is, in all probability, a close indication of the centre of the polar area.

PATERSON PURIFIERS AT THE SUMMER LANE GENERATING STATION, BIRMINGHAM.

The original generating plant installed in the Summer Lane Station of the Birmingham Corporation (see Electrical Review, October 26th, 1906) was provided with mechanical grease separators fitted in the exhaust trunks above the condensers of the generating sets. Owing to the unsatisfactory experience with these separators, it was decided to install Paterson purifying plant to deal with the exhaust from seven 2,500-h.p. Belliss engines, a proceeding which it appears has resulted in the satisfactory removal of every trace of oil from the water.

The Paterson standard oil eliminator of to-day varies inappreciably from that described and illustrated by us on page 391 in our issue of March 10th, 1905, but the Birmingham installation, on account of its size, entailed special arrangements. The condensed steam from the hotwell is discharged into a receiving tank, and from thence flows through the Paterson patent automatic measuring and chemical supply gear, similar to that described in our previous article, which supplies the reagent in accurate proportion to the amount of water passing. After thorough mixing in the mixing trough the stream is divided and flows into twin reaction tanks, where the bulk of the black oil separates out, and can be overflowed to the drain at intervals. The water then flows into Nos. 1 and 2 wood fibre strainers, each measuring 25 ft. × 10 ft. × 5 ft.

The semi-purified water overflows through bell-shaped draw-off pipes to the mains leading to the quartz sand filters. Where the highest degree of purification must be uniformly maintained, the quartz sand filters are absolutely essential; in this installation there are four filters, each of 9,000 gallons hourly capacity. When the quartz sand becomes choked with impurities, it is cleansed in place by agitating with compressed air from the air injector and flushing the impurities over into the waste gutter, and from thence to the drain. The filtered water from each filter passes through an inspection box, so that its condition can be seen at all times by the attendants before it overflows into a feed pump suction tank over the pump house.

The whole of the installation was carried out during the regular working of the station, and was brought into use without interfering with the operation of the plant.

The cost for chemical reagents was guaranteed not to exceed ½d. per 1,000 gals.; actually, according to a statement by Mr. R. A. Chattock, city electrical engineer, Birmingham, the figure for the month of June was ·169d.

The guaranteed drop in temperature of the water was not to exceed 10° F., between inlet and outlet; the drop with normal working was found to be less than 5° F. As, however, certain steam traps discharge into the wood strainers, the actual outlet temperature is somewhat above the inlet temperature.

Samples of the water tested by the local public analyst show no trace of grease in the treated water. The whole of the installation was carried out by the Paterson Engineering Co., Ltd., of Amberley House, Norfolk Street, W.C.

Westminster Athletes.—The country roads between Ruislip and Hanger Hill, Ealing, seemed to have been taken possession of by the Westminster Engineering Co. last Saturday afternoon. Stimulated by the recent Marathon race, some of the young and active employés of the company determined to show what they could do in this way, and a race between the above points, exactly 10 miles, was organised. The actual starters numbered eight, although a much larger number entered, and six of these finished the course, the official times being:—No. 1, Bird, 1 hour 2 minutes; No. 2, Curtis, 1 hour 2¼ minutes; No. 3, Weller, 1 hour 4 minutes; No. 4, Plimley, 1 hour 5 minutes; No. 5, Norman, 1 hour 11 minutes; No. 6, Gaskin, 1 hour 16 minutes. The record time for the distance is 57 minutes, so the performance is a very creditable one.

CORRESPONDENCE.

Letters received by us after 5 p.m. on Tuesday cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.

Peat and Lignite.

The contributor of the article "Peat and Lignite: Canadian Government Report on their Future," in your issue of September 4th, has been good enough to mention my name in connection with the matter, so perhaps you will allow me space for a few notes.

I have not had an opportunity of reading the report in question; but I have before me the pamphlet on "The Ekenberg Wet Carbonising Process," praise of which, as I gather from your article, is the feature of the report.

The cover of the pamphlet bears the motto or legend: "Peat converted into Coal." I do not, however, propose to discuss—for, indeed, upon the data before me I am not competent to discuss—the question whether the "coal" so produced can compete with mined coal in Canada, or in any specified locality. I will admit that it can do so, under certain conditions as to local fuel supply and cost of carriage, and that Dr. Ekenberg's discovery enables man to do, in a few hours, what Nature, in her leisurely fashion, took possibly millions of years to effect, and I heartily congratulate him upon a remarkable scientific, and apparently practical, accomplishment, probably widely applicable commercially under certain conditions.

I do not think, however, that it helps us toward a commercial solution of the problem "power from peat," because it does more than is required, and does it at too high a cost in money and fuel. The cost of conversion of "Peat into coal" by the system is stated to be 8s. 9d. per ton of (apparently) anhydrous peat, exclusive of interest on a capital cost estimated at £1 per ton of output per annum, and it also appears that one-third of the total bog mass is burnt to get, macerate, carry, pump, carbonise, and briquette the remaining two-thirds, which is the net available product—and this cost is prohibitive.

Fortunately the commercial solution of the problem "power from peat" does not require the prior conversion of "peat into coal"; but only the much simpler and much less expensive abstraction of 75 to 85 lb. of water for every 10 lb. of anhydrous peat in the original bog stuff containing 90 lb. of water to every 10 lb. of anhydrous peat. This Nature does every moderately fine summer for the meagrely equipped bog-cutter, in a few months, by the natural agencies of drainage and evaporation, and only fails when continuous excessive rainfall keeps undoing the work.

To me the problem presents itself thus: How in the cheapest possible way can we arrange that drainage and evaporation shall have the fullest possible play upon the bog mass, at the same time that the effect of rainfall is minimised or nullified, and how can time be best made an ally?

I think that attempts at solution along the lines of "conversion of peat into coal" are not promising, because too costly, and that success lies in quite other simpler and cheaper devices than the maceration, pressing, carbonisation, electric treatment and what not, to which these attempts at such conversion have given rise.

This, I may say, is not an opinion suddenly arrived at, but is deliberate and the result of much consideration and investigation in preparation for a paper on the subject.

Thomas Tomlinson.

Dublin, *September 10th*, 1908.

Auto-Transformer Installations.

With reference to Mr. G. Clifton's letter on this subject in your issue of the 4th inst., from practical experience, I am in a position to state that a large percentage of the wiring (in the areas of undertakers who supply alternating current) is unsuitable for changing over to 25 volts unless the consumer is prepared for—

1. The fluctuation of the light which undoubtedly takes place as lamps are switched on and off.

2. The possible invalidation of his fire-insurance policy, due to the wiring being inadequate.

3. The risk of a burn-out of the transformer, which would result in all lights being extinguished until a new transformer could be supplied.

When auto-transformer installations are tried, I find that instead of the consumer being satisfied by substituting 25-volt lamps, there is a tendency (and quite natural, because the light is insufficient) to increase the lighting by adding lamps here and there.

The cost of purchasing and fixing an auto-transformer, and the consequent loss occasioned by the magnetising current being registered continuously on the meter (unless a switch is fixed, which, after the first few weeks, is found to be a nuisance and is seldom used) shows that it is not in the consumers' interests to fix the apparatus when reliable 16/25-C.P. 100-volt metallic-filament lamps can be obtained at about 2s. 6d., and those for higher voltages and lower candle-power will, I understand, be placed on the market shortly.

B. W. H.

Replying to Mr. G. Clifton, who asked in last week's REVIEW for information *re* practical experience with metallic-filament lamps and auto-transformers, we have pleasure in stating the following facts.

We believe we were the first firm in these islands to install metallic-filament lamps of low candle-power and voltage on a practical scale. We experimented with them early in 1907, and having satisfied ourselves as to their economy, &c., placed an order for 10,000 Osram lamps of 25 volts, 10 and 16 C.P. We designed and built the transformers ourselves, having special regard to the open-circuit losses, which we kept very low; so much so that, with few exceptions, the meters do not register them. This is of great importance, seeing that the transformers are never switched off.

During last winter we manufactured and erected some hundreds of transformers from $\frac{1}{8}$ to 3 KW., and installed over 17,000 Osram lamps, with an average saving to our customers of 66·6 per cent., the lowest recorded being 62·3 per cent. We have in all cases replaced 16-C.P. carbon-filament lamps by 16-C.P. Osrams (which are rated in Hefner candle-power), and 8-C.P. carbon lamps by 10-C.P. Osrams. Where the original lamps were larger than 16 C.P. each we increased the number of lamps.

In practice we found the illumination given by the 16-C.P. Osrams was quite as good as by the carbon lamps replaced, being decidedly better in a number of cases. This was no doubt due to the whiter light emitted, and also to the fact that the carbon lamps fall off in candle-power very rapidly. The majority of those we replaced, although nominally of 16 C.P., were not giving more than 12 or 13 C.P. when removed.

Where shop and house lighting are combined we use an auto-transformer with two tappings, giving 100 and 25 volts respectively, and enabling us to use the large lamps in the shop and the small ones in the house, &c. It is obvious that being able to use a smaller unit of light in lavatories, passages, &c., is of great importance.

These 25-volt lamps also partially meet Mr. Sowter's remarks in the same issue *re* the first cost of lamps, and we may further say that all our customers are satisfied that after allowing for all renewals there is a clear saving of at least 50 per cent.

The Ampere Electrical Co.
per H. F. CLAYTON.

Dublin, *September 8th*, 1908.

Are Electrical Engineers Doomed?

I consider it my duty to warn my brother electrical engineers that our livelihood is to be torn ruthlessly from us by the dynamotor.

This wonderful invention, so I am informed by a friend who attended the last meeting of shareholders, and was good enough to give me the annual report, which I enclose, will (so says the inventor) for a capital cost of £300 supply sufficient electricity for the entire lighting, heating, cooking and power at the Hotel Cecil at a *total* running cost of £5 per annum.

These dynamotors, it is claimed by the inventor (Mr. Frost), who has been working on the patent for 20 years, can be made in any size, the capital and running costs being in proportion to the output.

So far as I can gather, the inventor uses a few dry cells to "excite" the dynamotor, which in turn drives the dynamo, and there you are!—50 H.P. from six cells; oh! so simple.

The confidence of the public seems marvellous; even so much so that £1 shares are reported to have changed hands at £25 each, and the secretary is said to have offered at the last meeting to buy up any number of £1 shares offered at £10 each.

You will notice by the balance-sheet that the premiums on these wonderful shares, which have never paid a dividend, are sufficient to pay all the yearly expenses.

I am told that there were several "electrical experts" at the meeting. I wonder what they have to say on the matter? Perhaps they are keeping it dark, and buying up dynamotor shares!

If you can enlighten me on this matter, or find me a more certain occupation, you will relieve the anxious mind of

Jos. Pownall.

London, N.W.,
September 9th, 1908.

[The balance-sheet, in type-writer characters, is dated February 29th, 1908, and shows a capital of £6,796 15s. 4d., of which £5,000 has been paid to the vendor. It is audited by two of the directors—Messrs. M. de Moro and H. Hawkins—and was to be submitted to the fifth ordinary general meeting at the works, Homerton, on September 2nd. Comment on the scheme outlined by our correspondent is superfluous.—EDS. E.R.]

Re Country House Fires.

With reference to the most disastrous fire at Burley-on-the-Hill, which occurred some three weeks ago, we had recently installed the electric light there, embodying a self-contained plant, and you may be interested to know that I saw my client last week, when he told me that the installation we had carried out was a "wonderful advertisement" for the electric light. In his interview with the various newspaper reporters, he pointed out that all the electric lamps were alight through the dense smoke in the various parts of the house, with the result that they enabled many valuable pictures and relics to be saved. It was not until the flames finally consumed the whole of the electric lighting tubes and fittings that the light was extinguished.

You have no doubt read in the daily papers that the fire was caused by the heat generated from a modern boiler, the flue of which had been inserted into the ordinary chimney of a room in the basement, and that it therefore set fire to the wooden beam which is generally known to exist in old country house chimneys.

Leo Sunderland.

London, S.W., *September 11th*, 1908.

Electric Lifts.

In your issue of the 11th inst., you have an article dealing with "Automatic Lifts," in which a correspondent points out "a very serious disadvantage from which these lifts suffer," the *defect* being that the cage cannot move unless the landing doors are closed. This defect is just one of the safeguards of the automatic lift, and, moreover, in a properly constructed automatic lift the doors must also be self-closing, otherwise the lift becomes useless if the last occupant leaves them open. Further, it is always essential that the person in the cage should have control, and for this reason, it is usual to fix a spring floor so arranged that the moment the passenger steps into the cage, his weight works a small concealed switch, which at once puts out of action the push-buttons on all the landings. By this means, from the moment the landing door is opened to receive the passenger until that moment when he allows the landing door of the floor he alights at to close behind him, no other person can interfere with the movement of the cage.

As regards the speed of lifts of this type, the difficulty of

travelling faster than about 140 ft. per minute, is to find a means of stopping without too much of a jerk. As it is usual to stop at floor level, one must rely on the brake coming into action the moment the automatic switch cuts off the current, and it therefore follows that the greater the speed you are travelling at, the greater will be the stopping jerk. If the brake could be adjusted so as to allow for a certain amount of slip, this difficulty could be overcome, as in the case of a lift controlled by a hand switch in the cage, when it is possible to cut off the current a foot or so before reaching the landing level thus allowing the cage to come to rest gently. But what has to be taken into consideration with the automatic lift is that the load is constantly varying, while the travel of the arms actuating the switches does not vary, and therefore very careful adjustment of the brake must also be taken into consideration, otherwise the cage would only stop at floor level with certain loads. It must be remembered that, in small lifts, the variation of the load is in very large proportion to the total weight of the cage.

The Titan Lift and Electric Co.
REGINALD W. SELBY.

London, W.C., *September 12th*, 1908.

Tariff Alterations.

I have read Mr. E. E. Hoadley's article under the above heading with the greatest possible interest, particularly as the opinions expressed therein entirely coincide with my own.

Some time since I formulated a scheme for dealing with very small consumers on precisely similar lines. I realised that the difficulties of supplying cottage property, where, perhaps, only three lights are required, were very great. First, there is the difficulty of getting tenants or their landlords to spend money in wiring the houses; secondly, the expense of purchasing meters on the part of the supply authority and the cost of meter line by the consumer; and, third, the trouble in getting these small consumers to pay a quarterly account.

I, therefore, realising the profitable nature of the business of supplying these small consumers (always provided that the capital costs incurred in so doing can be kept at a low figure) formulated a scheme whereby small dwellings, having a rateable value of £15 per annum or under, should be wired for three 35-watt metal lamps free of cost and a weekly rental of 1s. to be charged and collected weekly. An agreement would have to be entered into whereby the consumer agrees to take a supply for not less than one year, and that all lamp renewals after the initial installation be made by the consumer. The cost of connecting and wiring would not exceed 40s. per house. Thus we should secure a certain revenue of 52s. per annum for a capital outlay of 40s.

Unfortunately, however, it is often difficult to persuade a local authority to depart from the beaten track and to enter into a scheme which has not been carried out successfully elsewhere, whereas, the directors of a company having a financial stake in the concern are not quite so conservative, with the result that companies can frequently point to a larger lamp connection *per capita* than municipalities. At any rate, my scheme was not adopted, on the ground that consumers taken on under these conditions would "use the light night and day." One gentleman, a grocer by trade, clinched the argument by suggesting that if he sold, say, butter, on similar terms, he would soon be bankrupt.

What is wanted by small undertakings is revenue, and, as Mr. Hoadley truely says, a consumer charged by meter considers he has no check on the supply authority. Whereas, if he undertakes to pay a fixed charge, he knows exactly what he will be called upon to pay, makes provision to do so and is satisfied.

As the question of netting small consumers is of paramount importance to many undertakings, I trust we may hear the opinions of other engineers on this subject.

Wm. J. U. Sowter.

Electricity Works, Bray.
September 7th, 1908.

Metallic-Filament Lamps.

I cannot agree with the closing paragraph of the letter in your issue of 4th inst., which says that the makers act contrary to their own advice about making up in the future what they lose in the present. List prices and discount are not so important to chief engineers of supply stations as they are to contractors who have to sell single lamps, deliver by messenger and charge to customer at list price. The contractor has, therefore, greater risks than the resident engineer.

Makers are not so open-handed towards contractors as your correspondent affirms they are to resident engineers; they are more given to refusing any compensation whatever to contractors for lamps which have blackened rapidly or given out prematurely.

But then the contractor is only a ——— contractor, and makers like to keep well within the good graces of resident engineers by having their lamps used for public lighting, by which a good advertisement is secured for the lamps, and thus the makers look to the orders which come later from the contractors to make good out of the latter's pockets, by refusing to replace wasters, any loss they may make by replacing defective lamps supplied to resident engineers.

Scrutator.

With reference to "Contractor's" letter, which appeared in a former issue, *re* the profitableness in dealing in the above, our experience is that such business has not paid us. We have had to buy these lamps in lots of not less than 50, sometimes 100, and on arrival they had all to be tested to see if any were faulty. To do this took time, and time means money. There was also the return carriage on faulty ones, and, even after returning, the makers refused to replace them. On being asked their reason, we received a reply stating that they could not do so owing to the lamps having the "filaments broken mechanically." On querying what they meant by this, we were met by the lucid (?) explanation that "they did not show signs of having broken electrically." No contractor can afford to lose the price of from six to one dozen lamps on every 50 he purchases, which has been our invariable experience. We wonder how long a contractor could keep a customer by such treatment, and by not replacing lamps that failed prematurely?

Another Contractor.

[Several letters have been received too late for insertion. —EDS. E.R.]

NEW ELECTRICAL DEVICES, FITTINGS, AND PLANT.

The "Streetlite" Fitting.

MESSRS. CUTLER, WARDLE & CO., LTD., of 35 and 37, Dickinson Street, Manchester, have sent us particulars of their "Streetlite" fitting. The metal top is made of heavy spun zinc, finished in black enamel or oxidised copper; a round disk is fitted at the bottom, covering the whole of the opening immediately above the glass portion. A ⅜-in. iron tube screwed into the disk passes upwards through the top of the lantern, and to this is attached a coupling for suspension from a bracket, so that the weight of the lamp is removed from the top of the metal part to the disk. The latter also carries the holders in a vertical position, and by fitting close to and joining the globe is made to act as a reflector. The upper portion of the globe itself for a space of 3 in. is opal, so that the whole of the lamp immediately above the bulbs and surrounding the upper part becomes a reflector, the shape of the globe being designed for this purpose. For ventilation a 1½-in. hole is made in the bottom of the globe, four small vents are made in the disk, and four vent holes are made in the top immediately below the coupling; these are covered with a cap which allows free ventilation, keeps out all weather and ornaments the lamp. The whole interior of the metal body is left for connecting the conductors without joints by using 5-amp. cut-outs, ceiling roses or connectors. The over-all size of No. 3 "Streetlite," for four lamps, is 13 in. diam. × 17 in. high.

Simplex Watertight House Service Fuse-Box.

In answer to the demand for a perfectly watertight fuse-box of good construction, SIMPLEX CONDUITS, LTD., Birmingham, have designed the box shown in the accompanying illustration. It is of the usual form, but the addition of a lip on the cover and a circular

india-rubber band allows of a watertight joint being made between the cover and the box itself. The most novel departure in connection with this is the arrangement for fastening, which is by means of a screwed key, with which the necessary pressure on the rubber

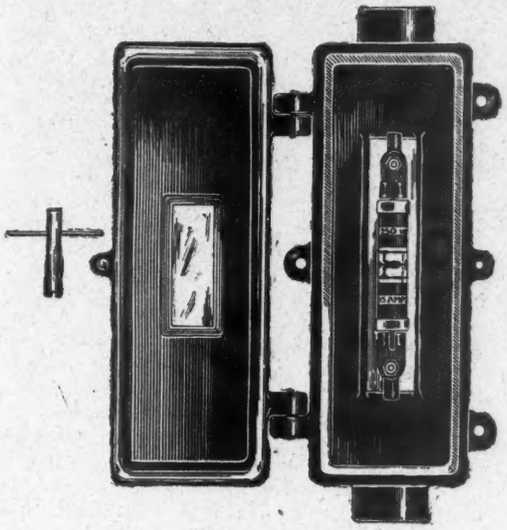


Fig. 1.—Simplex Watertight Fuse-Box.

band is obtained. The box is suitable for use with conduit up to 1 in. in diameter, either socket or screwed, and a small window is provided for inspection purposes.

Simplex standard enclosed fuses are used with this box, and all rubber parts are carried on porcelain bases. Three external lugs are provided for fixing.

Spiral Spring Conveyor Belt Idler.

In a discussion on belt conveyors reported in the *Journal* of the American Society of Mechanical Engineers, Mr. E. G. Thomas describes a new form of troughing idler pulley for conveyor belts; instead of the usual cast-iron pulleys, a flexible roller is used (fig. 2) consisting of a spiral spring, 5 in. in diam., rotatively supported in

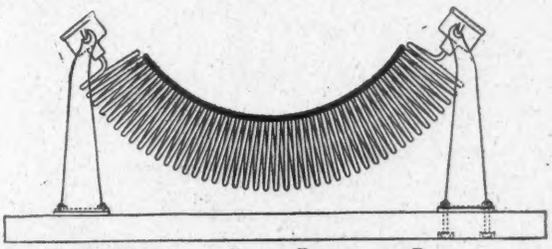


Fig. 2.—Spiral Spring Roller for Belt.

horizontally pivoted bearing boxes. The spring, under the weight of the belt and its load, stretches and sags to a smooth curve of approximately circular shape, and the belt bends to a troughed

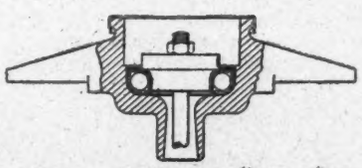


Fig. 3.—Ball Bearing for End of Spring.

form in contact with, and supported by, the spring across its entire width. As the spring is of the same diameter throughout, there is pure rolling contact at all points between the spring and the belt. The spring has about two coils per inch of belt width.

In all cases the spring is designed to have such strength that when the belt is carrying its maximum load the area of the cross section of the load will be the same as that of the ordinary 35 deg. three-pulley idler, so that the two forms have equal carrying capacity. Under any less load than the maximum the depression of the spring and the bending of the belt are less than the extreme values.

The pivots of the bearing boxes permit them to accommodate themselves to the varying direction of the pull of the spring as it is depressed more or less by the changes in load, and as the strain on the bearing is chiefly that of thrust, ball bearings are used to advantage, as shown in fig. 3.

By the use of this idler, the curvature of the belt, instead of being concentrated along certain longitudinal lines, is equally distributed across its entire width, and the degree of curvature is so small that wear from this source is practically eliminated. The weight of the spring is much less than that of corresponding cast pulleys, and the power required for its rotation in ball bearings is much smaller than is needed for the usual flat bearing with grease lubrication. The cost of lubrication will be reduced to that of sufficient light oil applied at long intervals to keep the bearings free from rust. In the conveying of material containing large masses, the spiral spring idler has important advantages, and because of its elastic character, will receive no damage from the shock of a falling lump which might break the rim of a cast pulley.

The "Robrow" Combined Rail Joint and Anchor.

Mr. Robert Brown, of 16, St. George Street, S.W., sends us particulars of a rail joint which he has devised. As shown in the accompanying illustrations, a saw cut is taken along the top of the web under the tread for any desired distance, and a vertical cut is then made through the tread to meet the end of the longitudinal cut, thereby removing that portion of the head of the rail. A similar longitudinal cut is made at the bottom of the web immediately above the base. The latter is then bent at right angles with

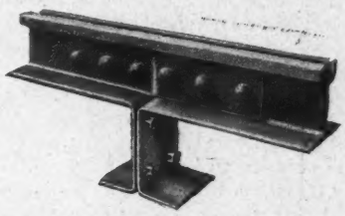


Fig. 4.—Complete "Robrow" Joint.

the rail at a point slightly behind the sectional face of the tread. The portion of the base which is bent downwards is again bent at some portion of its length, and bolt holes are punched in the web of the rail in the ordinary manner, as well as in the extended part of the web. The latter is cranked slightly to one side to admit of the tread of the rail being butted against the tread of the following rail, and the webs and bases are bolted or riveted together as shown in fig. 4. It is claimed that this forms for all new work the simplest and most effective joint on the market. It does away with fish-plates and independent anchors, and as the anchor is actually a part of the base of the rail, there is no possibility of the rail getting free from it; it also greatly simplifies bonding.

It can be made at the rolling mills out of the ends of the rails

Fig. 5.—Rail Ends prepared for Jointing.

that are always scrapped in the squaring of the rail ends. It will therefore come out at the same price per ton as the rails, and being less than half the weight of the combined fish-plate and anchor piece as used in present methods, it will necessarily cost less.

Insulated Tongs.

Mr. Fritz Lüling, of Küsnacht-Zürich, has introduced a device for handling live high-pressure fuses and connectors with safety. The tongs consists of a wooden shaft and an insulator tested to 40,000 volts, carrying an automatic gripper. The latter is applied to the fuse, the jaws opening to receive it, and a quarter turn of the

Fig. 6.—Safety Tongs.

handle locks the fuse in position, so that it can be withdrawn from the sockets without fear of mishap. The operation of removal or replacement can be carried out in perfect safety and with one hand—the latter feature being claimed as unique. Liners can be used to make the tongs fit any size of fuse. The device is made in three sizes, from 30 to 90 mm. in diam. of jaws, and 35 to 70 cm. long.

E

STEAM TRAPS.

By GORDON STEWART.

In preparing an article upon steam traps one is dealing with a subject of somewhat limited scope, but nevertheless one of very wide application, for these useful little fittings are called upon to fulfil duties almost as varied as they are essential. It will be my endeavour to include as much as possible of useful description and criticism as may bedeemed advisable, considering the space at my disposal.

I therefore purpose to deal with steam traps in general as regards the principles upon which the various best-known makes rely for their proper and efficient working, and shall supplement my remarks by illustrations and descriptions of how these principles are employed.

In the employment of steam for such uses as modern civilisation demands, we are faced, in the majority of cases, with the absolute necessity of obtaining our medium in as dry a form as possible. Absolute dryness, however, can only be obtained at somewhat great cost. Hence we are usually satisfied when we adopt every reasonable means to prevent the steam from becoming wet, and supplement them by the employment of appliances to rid the steam of its obnoxious wetness factor just previous to its use.

Steam may be regarded as being either "dry," "superheated," or "wet." The meanings of the first two terms need no explanation; but it would perhaps be advisable to consider what is really meant by "wet" steam. Wet steam may be looked upon as steam which is rather a mixture of dry steam and unevaporated water, and in which the presence of the latter may be considered as being due to one, or both, of the following causes:—Condensation in the mains, and entrainment from the boiler.

The otherwise dry steam may become wet through the entrainment of minute particles of water which become intimately mixed with the steam, due to one or many well-known causes. For instance, water may become entrained by the steam as it rushes at a high velocity from the steam space in the boiler. This is especially noticeable when the output of the boiler is being forced. Also, should the steam liberating surface of the boiler be relatively small or the water be of a scummy nature, this entrainment is liable to assume serious proportions.

Entrainment combined with condensation, which always takes place to a greater or less extent, is the prime cause necessitating the introduction of appliances to rid the steam of its moisture. There are, however, numerous devices which an engineer may adopt to reduce this wetness to a minimum; such as by a large steam liberating surface in the boiler, and the lagging of the steam pipes with asbestos or some other suitable non-conducting pipe covering, &c.

When, however, every practical means has been employed to prevent wet steam from passing to the engine stop-valve, a mechanical means of separating the water from the steam must be resorted to; this generally takes the form of a separator, situated immediately on the boiler side of the engine stop-valve, the function of which is to separate the entrained and condensation water from the steam by causing it to pass over and between baffles, or by a centrifugal action to catch up the globules of water and allow them to drain away into a receptacle at the bottom of which a steam trap is fitted.

What are the most essential prime functions of steam traps? First, they must be capable of removing all water of condensation from the system under drainage; secondly, they must do so without wasting live steam; and thirdly, they must do so without requiring constant attention from the man in charge of them. In order to ensure these three functions in their proper degree in any one trap, I would strongly advise the following points to be sought for in their design. By far the most important feature is whether the trap is or is not addicted to the vile habit of dribbling—that is, of allowing steam and water to be continually leaking through the valve; for under such circumstances the waste of steam will be considerable, and the detrimental action of the escaping steam upon the valve and its seating (this action, if anything, being far more destructive than that of a compressed-air blast) will in time score the valve and its seating to such an extent that a continual loss of live steam will result. The perfect discharge should be after the nature of sudden gusts, with a positive "stop" and "start" action of the valve, as by this means it would be possible readily to detect an error or possible mal-adjustment, and the loss of steam would be practically *nil*.

By far the greatest advantage of such a discharge is the fact that, the trap being positive in action, without any tendency to dribble, it is impossible for water to back up the pipe leading to the trap, which, in some cases, might lead to disastrous results, not only to the system under drainage, but to human life and property. For instance, it is quite possible to imagine the water backing up the pipe leading from an engine cylinder to its draining steam trap, which, if allowed to continue, may result in the cylinder cover being blown off. As regards efficiency from a thermal point of view, a trap, besides presenting a small surface to the cooling action of its surroundings, should, as far as possible, discharge the water at a temperature not very different from that due to the pressure at which it was formed; and in this connection I would point out that whereas many people are under the impression that steam traps of the expansion type are in this respect extremely wasteful, from the fact that they always appear to be discharging live steam, this is not the case. From its nature a good expansion trap is extremely sensitive to small variations of temperature, with the result that it will frequently open to discharge a very small quantity of water at a time, almost as soon as it has reached the expansion member, so that, when once past the valve, having been discharged as water of condensation under pressure, it is immediately converted into steam under atmospheric pressure. The discharge would then be considerably over 212° F., dependent, of course, upon the steam pressure in the system under drainage. Of course, there are instances in practice in which it might be found advisable to discharge even live steam with the water, as, for instance, in connection with the draining of the steam jackets of an engine cylinder, or of a boiling pan at a constant temperature, for under these conditions it might be found preferable to sacrifice efficiency in one direction for the sake of greater efficiency in some other direction.

Yet another commendable feature in a trap is that its valve should remain wide open when cold, so that it would be impossible for any water of condensation to remain in the pipes when they were not in use; for in the event of live steam being again turned on, should there be any water locked in the pipes, the inevitable water hammer would be set up, which, as is well known, might lead to most disastrous results. The following points should also be sought after:—Accessibility of the working parts, such as the valve; these parts should be few in number, and should be of a good steam resisting material, and should be relieved, wherever possible, from buckling or other straining action. They should have a wide range of working pressure for one adjustment and should be capable of discharging against a head. I may mention in this respect, that it is usual to allow 2 ft. of lift for every lb. of steam pressure, this being a safe working figure for mine or marine work. Of course, when discharging against a head the precaution of fitting a non-return valve on the discharge side of the trap should never be neglected. There are other features peculiar to each type of trap which should be investigated. These I hope to deal with as occasion may arise.

There is an immense number of different traps upon the market—good, bad and indifferent. It is not by any means an easy matter to classify them. However, for the purpose of this article, I propose to divide them in accordance with their principles of working into the following five classes:—

Class 1.—Expansion steam traps, or those which depend for their working upon the alternate expansion and contraction of metallic rods or tubes. This class is often spoken of as "Differential Expansion" and sometimes as "Controlled Expansion."

Class 2.—Float or bucket steam traps, or those which depend for their working upon the action of a float or

bucket so situated as to operate a discharge valve, the movement being controlled by the amount of water present.

Class 3.—Thermostatic steam traps, or those which depend for their working upon the alternate expansion and contraction of a volatile fluid confined in a restricted space.

Class 4.—Differential water pressure, or those which depend for their working upon the pressure due to the difference of head of two columns of water acting upon the opposite sides of a diaphragm, this latter being so situated as to control the motion of the discharge valve.

Class 5. — Return feed systems, or those especially designed to return the water of condensation into the boilers.

I purpose to deal with each class in turn and will endeavour to show how the good points, previously mentioned, are obtained and how the evil ones are guarded against. In doing so I shall not endeavour to show that any one trap is the best, but will attempt to exemplify the various principles of their working by reference to typical designs representative of the above classes.

In dealing first with those dependent for their action upon the expansion and contraction of metallic rods or tubes, I am confronted with the fact that designers are compelled to use the following short list of metals—iron, copper, brass, steel and nickel steel. These have the following coefficients of expansion :—

Iron ...	... 0·000013	Steel ...	... 0·000012
Copper ...	... 0·000017	Nickel steel	... 0·00000133
Brass ...	... 0·000018		

The most striking figure in this list is that against nickel steel, which, as will be seen, is about ten times less than that against iron. This material, consisting approximately of about 36 per cent. nickel and 64 per cent. steel, has provided us with a very useful expansion member; for previous to its introduction, those designers who employed pure differential expansion of two members of different material were compelled to use steel and brass, these being the two most suitable metals available, with a sufficient difference in their coefficients, which in this case are practically in the ratio of 7 to 10. Under the circumstances, however, only 30 per cent. of the actual expansion would be available, the other 70 per cent. being lost in their joint expansion. So that nickel steel, besides being in great demand, on account of its strength, by constructional engineers, and more recently for motor-car construction, where great strength with lightness is such an important consideration, has been eagerly utilised by recent designers of steam traps. The most noticeable instance of this is in connection with the trap designed by Mr. Wm. Granger—a description of which will follow shortly.

(*To be continued.*)

BUSINESS NOTES.

Consular Notes.—ARGENTINA.—The British Consul at Rosario reports that the electric tram service of the town, in the hands of a Belgian company, is nearing completion, and several sections have been inaugurated during the year. Suburban property has consequently risen in value. The extent of track when completed will be 75 miles, and the total cost 18,000,000 fr.

ST. PIERRE and MIQUELON.—The British Consul at St. Pierre reports that there are two telegraph cable stations in the town, the Anglo-American Cable Co. and the French Cie. Francaise des Cables Telegraphiques. The routes of the former are (1) through Newfoundland and Ireland; (2) to North Sidney, Cape Breton; and (3) to Duxbury, Massachusetts; those of the latter are laid direct to Brest on one side, and to Cape Cod on the other.

TURKEY.—The British Consul at Damascus, in a recent report, states that a line of 3½ miles of electric tramway in the town was ready and open for traffic on February 7th, 1907, but the lighting system was not finished until July. Very few private houses are as yet lighted by electricity, but it is expected that most of the well-to-do people will soon adopt it. The hotels, coffee-houses and theatres are now nearly all lighted by electricity, besides the great mosques and the principal streets. The railway stations are not so lighted.

FINLAND.—The British Consul at Helsingfors reports that the electric railway from Hyvinge station to Naasestate, a distance of 9·3 miles, built at a cost of about £16,000, has been in operation since January, 1908, and was recently officially inaugurated. This line may probably be extended to Hango and Forssa. The Consul states with regard to the telephone system of Helsingfors that the number of subscribers, viz., 7,000, out of a total population of about 160,000, is very high, and he adds that seeing that telephones are not a Government monopoly, and that their cost never exceeds £3 3s. per annum, further explanation of their general adoption is unnecessary.

SIAM.—The British Consul at Chiengmai reports that there were few interruptions during 1907 in the telegraph service, and now almost all the principal towns are linked up to one another by wire. During the latter half of 1907 a start was made to put posts and wire from Chiengmai to Mehongson. This, when completed, should be of great value, especially in dealing with elephant thefts, as at present the whole of the important western (Salween) district is devoid of both postal and telegraph services.

PARAGUAY.—The British Consul at Asuncion, in a recent report, states that, during 1907, telegraphic communication was established between Asuncion and Villa Encarnacion. This line consists of 1,945 km. (1,208 miles) of wire, at a cost of about $32,344 (£6,469). A cable between the same town and Posadas is shortly to be laid, and will thus connect Paraguay and Argentina by one single line. Telegraphic communication between the town of Bella Vista, on the Brazilian frontier, is also in course of construction, and will, when completed, unite these two countries as well. A wire from the village of Jhu to the River Parana, opposite the Jguazu Falls, is also contemplated.

BRITISH HONDURAS.—The Colonial Secretary of British Honduras, in a recent report, quotes the following figures of telegraph and telephone transactions in the years 1904-7 :—

	Telephone calls.	Telegrams.
1904	6,926	2,422
1905	15,305	7,992
1906	14,887	10,195
1907	19,023	12,089

The working expenses of the system amounted to $9,399 in 1907 and the receipts to $5,465. The route of the northern line between Orange Walk and Corosal has been changed, and the line now follows the high road and brings the important village of San Estevan into communication. The service on the northern section is now fairly regular. The southern section is not so satisfactory, but it is being improved. There is no regular through communication with places beyond the Colony, but a private firm has made arrangements for receiving telegrams at Consejo in the Colony, sending them by boat to Payo Obispo, and then transmitting them by the Mexican line. This line has been subject to occasional interruptions, but usually telegrams sent to or from Belize reach their destination within 24 hours. Negotiations are in progress with the Mexican Government for the establishment of a through service.

RUSSIA.—In a recent report on the trade of Russia, H.M. Consul at St. Petersburg calls attention to the following figures of the output of copper in that country, which are not without interest. According to the preliminary figures published the total quantity smelted in the country was about 14,401 tons, which is stated to be a record as compared with previous years. The quantities produced at the various works in 1907 as compared with the years 1905-6 are given as under;—

	1905. Tons.	1906. Tons.	1907. Tons.
Ural works	3,641	4,654	7,338
Caucasian works ...	3,609	3,754	4,854
Siberian works ...	1,080	653	1,129
Other works ...	869	1,204	1,080
Total ...	9,199	10,265	14,401

To the above quantity of 14,401 tons, some 4,500 tons must be added representing the import of electrolytic copper. At the present time Russia's capacity for producing electrolytic copper is far short of satisfying the demand. For the moment there is only one electrolytic plant in the country capable of producing a larger quantity, though it is interesting to note that in the near future a British-controlled plant will begin operations in the Urals at Kyshtim. Last year Russia's consumption of electrolytic copper was about 5,700 tons, of which native works produced 1,200 tons, while, as stated above, 4,500 tons were imported. The total quantity of ordinary ingot (non-electrolytic) copper consumed in the country was about 13,000 tons, and about 1,400 tons was exported, this latter figure representing the surplus, in excess of home requirements, of ordinary ingot copper. The figures, therefore, may be epitomised in the following manner :—

	Tons.	Tons.
Balance from 1906	800	
Smelted in 1907	14,401	
		15,201
Electrolysed in Russia ...	1,200	
Exported	1,400	
		2,600
Home consumption of ingot copper		12,601

There is a heavy duty on copper imported into Russia approximating £33 per ton, but in spite of this fact the trade is by no means in a healthy condition, the main reason being apparently the excessive cost of output. There are at the present moment three British copper producing companies working in the Russian empire, one in

Siberia (Spasski), one in the Urals (Kyshtim), and one in the Caucasus (Caucasus copper).

Italy.—The Austrian Consul at Genoa, in a recent report, states that the production of electrical energy from water power and its transmission over long distances is one of the Italian industries which, owing to particularly favourable local conditions, has witnessed a remarkable development. Since the possibilities of this industry were realised, Italy being a country poor in coal, has richly profited by them, and at the end of last century numerous wealthy companies had already undertaken the production and distribution of electric energy from water power, particularly in Lombardy and the Alpine districts of the country. But in the last few years the development of this hydroelectric industry, attended by an expansion of industry in general, has been wholly beyond anticipation, at least 100 companies having been formed. The largest installations are to be found in the provinces of Novara, Turin, Milan, Bergamo, and Brescia, but there is hardly a town in the Consular district of Genoa which has not its own electric plant, and one must press far into the Alpine district to obtain a concession for the utilisation of water-power. Italy already possesses some of the largest electrical works, but in the near future even larger works are to be erected on the Adamello River in Lombardy. The Societa Lombarda will have about 100,000 H.P., and the Edison Co. over 90,000 H.P., and of the whole water-power available in Italy— estimated at about 5,000,000 H.P.—about 1,000,000 H.P. are already being used for the production of electrical energy. In 1907 the number of electrical works in the provinces of Genoa and Turin amounted to 577 and 408, respectively, as against 492 and 338 respectively in 1905. At Genoa the State railways have installed a 15,000-H.P. steam generator set for the supply of electrical energy for traction purposes on the Triovi lines. The Officine Elettriche Genomi have also extended their works for the production of electrical energy, so that they now produce over 20,000 H.P. A hydro-electric plant at Isola, near Spezia, has also been completed, and represents a power of 13,000 H.P.; the greater part of this power is intended for the Spezia Arsenal, and the remainder for industries to Sarzana and Carrara. The development of the machine industry continues from year to year, but it is not yet in a position to cover more than half of the demand, and many fine and special machines are imported from abroad. The greatest strides are shown in the construction of steam engines, motors, and machines for electrical purposes. There are 18 works for the construction of locomotives and wagons, and during the last three years the railway authorities have given so many orders to these works, that they have not been able to give delivery within several months. In 1907 locomotives and rolling stock to the extent of 215,000,000 lire were ordered, but in consequence of a great demand the railway authorities were obliged to give orders abroad for rolling stock to the value of 20,911,000 lire. The greater part of these orders was given in Germany. The Société Anonima Westinghouse has been formed with a capital of 10,000,000 lire, and has erected large works in Vado, Liguria, for the production of electrical material particularly for railways, electric locomotives, &c.; the company is busy with orders from the State railway authorities.

Later, in his report, the Consul states that it has been decided to install electric traction on certain railways to be completed between 1906 and 1911 for which 38,260,000 lire has been voted for construction purposes, and 13,476,000 lire for rolling stock. These lines are as follows:—Pontedecimo-Busalla, Genoa lines, Savona-S. Guiseppe, Demodossola-Iselle, Gallarate-Arona, Gallarate-Laseno, Milan-Lecco, Usmate-Bergamo, Bardonecchia-Modane, Napoli-Salerno, Torre Annunziate-Castellamare, Pistoia-Bagni delle Porretta. It is intended that by the year 1915 the railway traffic shall be so organised that deadlocks in working, such as those which have been experienced in recent years, will be impossible.

United States.—The Austrian Consul at St. Louis reports that that town is the chief place of construction of railway cars, tramcars, and goods wagons in the States. In 1907 2,000 tramway cars valued at $6,500,000, and railway carriages to the value of $25,000,000, were constructed. Moreover, 25,000 goods trucks valued at $25,000,000 were constructed.

Greece.—The Austrian Consul at Piræus, in a recent report, states that in 1907 the electrification of the tramways of Athens gave rise to supplies of cars, rails, cables, iron posts and various other electrical goods; as the tramway company is Belgian and the electrical company American, the cars were purchased in Belgium and the other material mostly in the United States. It is thus again proved that the orders for material required in such works as this are given in the country from which the capital is drawn; the best impetus that can be given to the export trade of a country is given by the exportation of capital for use in foreign industries.

Bermuda.—The Colonial Secretary of Bermuda, in a recent report, states that there is no inland telegraph in that island. An efficient telephone service throughout the colony is worked by a private company. The cables of the Halifax and Bermudas Cable Co., Ltd., and the Direct West India Cable Co., Ltd., both of which companies are under subsidies from the Imperial Government, connect Bermuda with the outside world through Halifax on the one hand and Turk's Island and Jamaica on the other. The cable to Halifax was laid in 1890, and that to Turk's Island and Jamaica in 1898. The company also have a cable between Hamilton and St. George's for the use of the public.

The Kent Collieries Installation.—At the annual meeting of the Kent Collieries, Ltd., held last week in London, Mr. Atkinson, who said he held 9,000 shares in the company, and was a director of the firm to whom the directors alluded in their report as "electrical contractors," said he thought it a pity that the board should still maintain that the cause of failure to achieve success was due to the electrical contractors. He went on to contend that the delays had been due to the action of the board of the Kent Collieries Co. He quoted from the judgment of the Official Referee in the action which was recently reported in our pages, in support of his contention.

E.C.C. Hospitals' Fund.—The annual meeting of the Electric Construction Co.'s Hospital Committee was held in the Works Institute at Bushbury, on Wednesday evening of last week, to arrange for the distribution of funds to the various charities of the town. The amount available for distribution was £153.

Claim for Workmen's Wages.—At Croydon Police Court recently, the Weber Concrete Construction Co., Ltd., of Queen Anne Chambers, Westminster, were summoned by six workmen for wages due in connection with a contract undertaken at the Croydon Electricity Works. The men, the evidence showed, were employed till July 31st, when they were told not to come again till the Wednesday after August Bank Holiday. On doing so, they found that the foreman had not arrived, but were told by telephone to "stand by the job." This they did till August 15th. Mr. A. C. Cramb, borough electrical engineer, said nothing had been done under the contract since the end of July, and he had been informed that the company was about to go into liquidation. The Bench ordered the amounts claimed to be paid forthwith.

New Danish Duties on Electrical Goods.—The new Danish Tariff Law which is to come into operation on January 1st next has been translated by order of the British Parliament, and was issued as a Blue-Book on the 10th inst. The following table shows the duties on electrical goods under the existing and the new tariffs:—

Classification.	Existing tariff.	New tariff.
Electric machines and parts (dynamos and electro-motors)	10 per cent. ad valorem.	7½ per cent. ad valorem.
Engine packing and insulating materials	10 per cent. ad valorem.	5/7½ per cwt.
Wire for electric current and cables and all kinds of wire having paper, textile, or other material spun round, woven in, or twisted round it ..	2/4½ per cwt.	7½ per cent. ad valorem.

Catalogues and Lists. — British Insulated and Helsby Cables, Ltd., Prescot. — Several new publications: No. P. 79, is a 24-page pamphlet containing a detailed description, with diagrams and many half-tones, of the Prescot electric welder. Nos. L. 26 and 28 show and give prices of several telephone instruments and parts thereof; L. 29 is a 16-page pamphlet concerning their telephone switchboards for generator and primary battery working; and a couple of leaflets give a few notes, and an illustration, of the Bates & Peard patent annealing furnace.

Messrs. Galsworthy, Ltd, 15 and 16, Newman Street, Oxford Street, W.—Booklet showing a three-colour view of their showrooms, also a number of effective illustrations (two colour) of their latest electric fittings.

Messrs. Davidson & Co., Ltd., Sirocco Engineering Works, Belfast.—New publication, No. 1,003 (40 pages), entitled "The Mechanical Ventilation of Mines," in which full particulars appear concerning their "Sirocco" fans. Photo-process pictures of some mining installations where these are in vogue are given.

International Time-Recording Co., 151-155, City Road, London, E.C.—Illustrated sheet showing a number of photographic views of engineering works, tramway depôts, and other large establishments where the company's system of automatic time-keeping and job-costing is employed. Some information concerning their very extensive use in all parts of the world is given.

Trafford Park Estates, Ltd., Trafford Park, Manchester.—Quite fittingly, when the new Patents Act is attracting attention to possible factory sites in this country, the excellent claims that can be advanced for Trafford Park as a suitable centre are being urged by this company in a folder pamphlet just issued. Very appropriately the circular has been printed in three languages (English, French and German), and we understand that it has been posted to more than 7,000 foreign holders of English patents.

Messrs. Green & Boulding, Ltd., 28, New Bridge Street London, E.C.—Catalogue, with prices, code words, &c., of their Buffalo automatic injectors, metallic packings, indicators and valves.

Messrs. Alfred Herbert, Ltd, Coventry.—Excellently produced catalogue of some 60 odd pages, in which they deal very completely with their Hexagon turret lathes, illustrating the evolutions of the machine from its first design in 1898 down to the present time. Each component part is described, and full illustrations for operating are included. We understood that the book is intended as much for the use of the workman as for that of the engineer's office.

The New Brotherton Tube Co, Ltd., Excelsior Works, Commercial Road, Wolverhampton.—New illustrated price list (No. 6), in which in the course of some 180 pages appear numerous illustrations, and tabulated sizes and prices, of their various Excelsior electrical conduits, and the innumerable fittings for use in conjunction therewith. Not the whole 180 pages, however, are devoted to these things, for a number of the opening pages contain excellent and interesting photographic views of the different departments at the works. Then at the other end of the book, from page 107 onwards, there is a collection of valuable statistical and general information, reprinted from a contemporary, concerning electricity supply undertakings in this country and abroad, also fire office rules, table of conductors, &c.

Correction.—The price list issued by Messrs. Davis & Timmins last week related to "bar finished" nuts, not "finished" nuts.

Messrs. John Davis & Son (Derby), Ltd., All Saints' Works, Derby.—Copy of their new surveying instrument list (No. 0081A), the 44 pages of which set forth illustratively and briefly descriptively particulars of a variety of their manufactures in this department. A number of new features which were not included in the last edition are illustrated, especially relating to transits for surveys which require great precision.

Messrs. Davey, Paxman & Co., Ltd., Colchester.—Twenty-four page catalogue (No. 517) concerning the Paxman improved "Otto" gas engines and suction gas plant. The list is illustrated and tabulates sizes, speeds, weights, code words and other like information. The double cylinder vis-a-vis gas engines, and the Paxman electric lighting type of engine, are described.

Messrs. H. Dunn & Son, 32, Newington Causeway, London, S.E.—Circular relating to their "Perfecta" electric signs, and showing a number of designs.

Messrs. Smith Bros., 25, King Street West, Manchester.—Price lists of arc lamp carbons (Noris-Excello) and of cables and wires.

Messrs. Mawdsley's, Ltd, Zone Works, Dursley, Glos.—New catalogue consisting of a large number of lists bound in an expanding binder case, in which are published full particulars of the firm's Zone generators and motors made under Mawdsley's patents. Various improvements which have been recently effected in the design are embodied. We gather that the firm's works have been extended, special plant for economical production in large numbers having been put down. Admirable illustrations appear of various types of machines, and tabulated sizes and shipping details are given together with diagrams of dimensions. Small petrol-electric sets (from 1 to 6 kw.) are also listed.

Messrs. W. H. Bailey & Co, Ltd., Albion Works, Salford, Manchester.—A very full catalogue of over 400 pages entitled "Bailey's Useful Inventions for Engineers in all Industries." Such a title indicates at once the impossibility of our attempting to enumerate the contents of the book in anything like detail. Perhaps it will meet the case if we say that it is bound to be a most valuable book to any engineer who is in need of such specialities as are herein described—and which engineer is not?—that it is elaborately illustrated, two-colour printing having been used at places, that it sets out prices of practically every article included, and that it is, as it professes on its title page to be, "an encyclopædia of valves and appliances for steam, water, acids, oils, spirits, air and gases; gauges, stop valves, reducing valves, safety valves, steam traps, steam kettles, lubricators and fusible plugs."

Mr. M. J. Eichhorn, 5,759, Aberdeen Street, Chicago.— Leaflet describing the trigonometric slide rule invented by Mr. Eichhorn—an ingenious device, by means of which the solution of triangles is brought within the compass of the slide rule; the familiar formula $c^2 = A^2 + B^2 - 2\,A\,B\cos c$ can be solved with the rule when either A, B or C is the unknown quantity, so that, as the author claims, almost any case in plane trigonometry can be dealt with.

Messrs. Falk, Stadelmann & Co., Ltd., 83-87, Farringdon Road, E.C.—Leaflet describing the "Sirius Efesca" metal-filament lamps, of 16, 25, 50 and 100 c.p. We have had two of these lamps, of 25 c.p. each, burning in series on 200 volts many hours daily for some weeks, part of the time in a nearly horizontal position, and they seem to be as good as new.

Mr. Charles Taylor, Bartholomew Street, Birmingham.—Leaflet and catalogue relating to his patent spiral self-centring chucks, which are so constructed that the pressure is applied as nearly as possible directly behind the article gripped, doing away with the tendency to tilt. Various patterns and sizes are shown of the chuck, which is capable of holding work against the heavy strain of high-speed steel tools—as evidence of which statement a steel chip measuring 2 in. × $\frac{11}{16}$ in. × $\frac{3}{32}$ in., cut in an 8-in. chuck, is sent with the catalogue.

Annual Outings. — The fourth anniversary of the British Electric Calibrated Fuse Co., of Harpenden, under the management of Mr. Weekes, was celebrated on Saturday last by an outing. Over 50 of the staff and fuse-makers drove in brakes to Bedford, where an enjoyable day was spent on the river. In the evening the party sat down to dinner, which was concluded by the usual toasts and smoking concert.

The employés of the "Metalite" lamp department of the Bryant Trading Syndicate, Ltd., of Highbury, went for their annual outing last Saturday week to Clacton-on-Sea.

Dissolutions and Liquidations.—The Electrical Instrument Manufacturers, Ltd.—A petition was presented to Judge Tindal Atkinson, at the Edmonton County Court on Monday, for the winding-up of the Electrical Instrument Manufacturers, Ltd., a company with a registered address at Freezywater, Waltham Cross. The petitioners were William John and Arthur Edward Berrill, advertising agents, of St. Bride's Street, E.C., for whom Mr. J. F. W. Galbraith appeared. No one attended on behalf of the company. The petition set forth that the company was incorporated in October, 1905, and that its nominal capital was £5,000 in £1 shares. The amount credited as paid up was £2,007. The business was that of electrical engineers, contractors, and tool and instrument makers. The company accepted a bill of exchange for £42, drawn by the petitioners, payable two months after date. It was dishonoured, and judgment was obtained on it in the High Court, in March, 1908, for £42 11s. and £7 10s. costs. Execution was issued, but was not satisfied. Notice was served requiring payment of the amount, but to no purpose. His Honour remarked that there appeared to be no assets to distribute. Counsel said that the petition did not go into that, but there was substantial machinery. While these proceedings were pending, one of the directors bought up the debentures and had since applied for a receiver and manager to be appointed. It was in evidence in that action that the machinery on the premises cost £2,000, while the debentures were only for £250. His Honour made a winding-up order.

Hillier & Co., mechanical and electrical engineers and boat-builders, Romsey.—Messrs. C. F. Brown and H. I. Lewens have dissolved partnership.

Meldrum Bros., Ltd., Timperley, Manchester.—First meetings of creditors and contributories are to be held at Manchester on September 25th.

J. P. Beckett & Co., Great Grimsby.—The partnership between J. P. Beckett and J. H. Trolley, electrical engineers, has been dissolved by mutual consent as and from January 1st, 1908. Debts will be attended to by the former.

Middleton & Co., Dover.—Mr. F. W. Balch has retired from this firm.

Lancashire Electric Supply Co., Ltd.—A meeting is to be held at 4, Chapel Walks, Manchester, on October 20th, to hear an account of the winding up from the liquidator, Mr. J. Collier.

Joseph Richmond & Co., Ltd., 30, Kirby Street, Hatton Garden, E.C.—A first dividend of 3s. in the £ is payable at the office of the liquidator, 2, Clement's Inn, W.C., on and after September 28th.

Trade Announcements.—The Gilbert Arc Lamp Co. have appointed Messrs. Parmiter, Hope & Sugden, of Hulme Electrical Works, 50, Ellesmere Street, Hulme, Manchester, to be their agents for Lancashire and Yorkshire, as from September 1st. Messrs. Parmiter, Hope & Sugden will keep a large stock of the Gilbert standard apparatus.

The business of Messrs. A. L. Lind & G. St. J. Wood, carried on as electrical manufacturers' agents, general electricians, and contractors, at 37, Moorfields, Liverpool, has been turned into a limited company with the title of "Lind & Co.," the capital being £5,000 in £1 shares.

The Armorduct Manufacturing Co., Ltd., ask us to inform the trade that they have recently secured the exclusive sale for Great Britain and the Colonies of the "Gral" high-voltage metallic-filament lamp, which is manufactured from 40 c.p. upwards, and in size is only $4\frac{1}{2}$ × $2\frac{3}{4}$ in. overall; an efficiency of 1 watt per c.p. is claimed. As soon as stock supplies are received the lamp will be put upon market.

Messrs. Egerton Lowe & Co. are commencing business at South View Crescent, Sheffield, as electrical engineers, and they invite manufacturers of a.c. and d.c. generators, motors, transformers, metal filament lamps, &c., to forward price lists.

Messrs. J. & H. Grevener announce that they hold a stock of flame carbons at their Newcastle branch, Milburn House, Newcastle-on-Tyne.

We are informed by Messrs. Morris-Hawkins, Ltd., of Dagenham, that Mr. Tom Hawkins is no longer managing director of, nor has he any interest in, the company. The constitution of the directorate is otherwise unchanged.

Time Switches.—Messrs. Venner & Co. have just received the Board of Trade approval for their time switch—the only device of the kind to receive this distinction, we understand. The firm have just issued a new Section 8 of their catalogue, which deals fully, giving description and drawing, with their type "B" switches, which are principally used in connection with the two-rate system of charging. We gather that this system is rapidly growing in favour, and Messrs. Venner have now some 70 or 80 stations that have this system in use, on their books.

Bankruptcy Proceedings.—E. & C. Braby, slate and marble merchants, Lambeth, S.E.—A first dividend of 4s. in the £ is to be paid to all creditors who agree to the estate being wound up under the partnership proceedings, in the Chancery Division. Mr. E. H. Hawkins, of 4, Charterhouse Square, E.C., is acting as receiver and manager.

Book Notices.—Messrs. Cassell are issuing on September 24th an entirely new technical serial entitled "Electrical Engineering," by Mr. Harold H. Simmons, A.M.I.E.E. We understand that while the treatment is elementary, the scope of the work is wide.

"Electric Furnaces." By W. Borchers. Translated by H. G. Solomon. London: Longmans, Green & Co. 1908. Price 7s. 6d. net.

We have received from Group IV of the French Section of the Franco-British Exhibition, a handsome brochure in French and English, describing the exhibits of machinery in the Section, as a souvenir of the Exhibition.

"Journal of the American Society of Mechanical Engineers." September, 1908. Vol. 30, No. 7. Baltimore: The Society. Price $1.

"The Management of Dynamos." By G. W. Lummis-Patterson. London: Crosby Lockwood & Son. 1908. Price 4s. 6d. net.

"Dämpfungsmessungen bei Telephonströmen." By Béla Gáti. Reprint from the *Zeitschrift für Schwachstromtechnik*. Budapest: From the author.

A Mining Exhibit.—At the Camborne Mining Exhibition the Union Electric Co, Ltd., have not only a well-equipped stand in the centre of the Exhibition, but they also have a large motor working an air compressor supplied by Messrs. Reavell & Co. They have also supplied the whole of the arc lamps for illuminating the Exhibition itself, both inside and outside, and part of the street approaches to the Exhibition. The company's "Excello" and "Kohinoor" lamps have also been adopted for the lighting of a number of the other stands. On the company's stand amongst the heavy machinery shown is a direct-coupled Plunger pump, with triple cylinder, 3 in. diameter × 6 in. stroke, and capable of delivering 1,375 gallons of water per hour against a high head. Owing to

want of space, and to the short duration of the Exhibition, the pump is not at work, but we understand that it will be transferred from Camborne to Manchester, and there be exhibited at work. Another heavy piece of apparatus is a direct-coupled electrically-driven centrifugal pump, arranged for drawing 80 gallons of water per minute against a head of 80 ft. Besides the foregoing the company are also showing a range of their polyphase and direct-current motors, and various forms of starters, arc lamps, the latter chiefly of the "Excello" pattern. It is stated that the company's works have constructed over 470,000 arc lamps of various kinds, and that everything used in the arc lamp is made on the interchangeable system, so that spare parts can be sent by reference number, and by post at very short notice. Other details on the stand consist of measuring instruments, electricity meters, circuit breakers, lever and turn switches, safety fuses, &c.

We understand that the Union Co. have been awarded a medal of the first class for the above exhibit.

LIGHTING and POWER NOTES.

Ashton-under-Lyne.—By a large majority, four members only opposing, the T.C. has decided to adopt electric lighting instead of gas, for the hospital, which is already wired. The Corporation will supply energy at 2d. per unit.

Ayr.—In the annual report of the T.C. electric lighting undertaking, the burgh electrical engineer states that the station output amounted to 1,375,192 units, an increase of 107,171 units over the preceding year, and the revenue was as under:—Private lighting, £6,718; power, £523; public lighting, £3,446; traction, £2,121; other sources, £210—total, £13,029. The ordinary expenditure was £8,619, and the payments of interest and to sinking fund amounted to £5,450, leaving a deficit of £1,039, as compared with a surplus of £926 last year. This is stated to be due to the cost of fuel and a reduction in the price of energy to private consumers from 4½d. to 3½d. per unit. On the recommendation of the Lighting Committee, the Council has agreed to raise the price of energy to private consumers to 4d. per unit from November 1st.

Bradford.—A comparative trial of electric and gas illumination for street work is being carried out in Manningham Lane—one of the principal thoroughfares. The electricity department has erected 18 2,500-c.p. flame arc lamps on the tramway poles for this purpose; the Gas Committee has not taken any steps in the matter yet.

British Columbia.—At the annual conference of the officers of the British Columbia Electrical Co. in Vancouver, recently, for the purpose of making appropriations for the company's lines, a sum of $112,000 was allotted for maintenance, extensions, &c., at Victoria, and close on $1,000,000 was appropriated for similar work at Vancouver, including the 70-mile transmission line to Chilliwack.

Burslem.—A L.G.B. inquiry was held on September 10th into the application of the T.C. for a loan of £12,000 for electricity purposes. Mr. H. R. Hooper, the Inspector, cross-examined the local engineer at great length as to the method of operating the destructor in conjunction with the electrical plant; also as to the scale of charges in force for power supply, in both cases apparently with a view to showing the unprofitable character of the undertaking. During the inquiry the Town Clerk observed that the Inspector's remarks did not encourage people to go in for electricity.

Bury.—A L.G.B. inquiry into the Corporation's application for powers to borrow £72,000 for local electrical developments, including the erection of new works at Chamber Hall, was held on Wednesday this week. Much local opposition has been aroused against this proposed expenditure.

Clacton-on-Sea.—A L.G.B. inquiry was held on Tuesday into the Council's application for a loan of £500 for two small engines, with new generators, switchboard, &c.

Darwen.—On September 10th an inquiry was conducted by the L.G.B. into an application by the Corporation for powers to borrow £4,300 for the new electricity undertaking.

Denny (Stirlingshire).—The British Insulated and Helsby Cables, Ltd., having sent an amended offer to execute the whole work in connection with the electric lighting scheme for the lump sum of £763 14s., this was approved of by the Town Council. There was also submitted to the Council an agreement in duplicate between the Council and the Scottish Central Electric Power Co., regulating the terms and conditions on which the company is to supply the Council with electrical energy. It has been agreed that the charges for electricity should be collected by the gas officials, the accounts in connection with the electric undertaking being kept by the gas treasurer. Mr. A. T. Lunn, burgh surveyor, has been appointed engineer and manager of the electrical undertaking.

Dublin.—At an adjourned meeting of the Corporation held on the 11th inst, it was decided that an inquiry into, and report on the financial position of the electricity undertaking should be made for the Council, and that reference should be made to the original estimates by Mr. Hammond, and promises made by the Committee in regard to extensions, and how far they had been materialised.

Edinburgh.—The Electric Light Committee of the T.C. has agreed to reduce the minimum charge for energy for motors from £2 to 30s.

Enniskillen.—The U.D.C. has decided not to take any action in regard to the offer of a firm of consulting engineers to lay before it a proposal for an electric lighting scheme.

Falkirk.—The Electric Light Committee has recommended the T.C. to reduce the price of electricity within the burgh for lighting purposes from 5d. to 4d. per unit. It is also recommended that, in the case of lamps exhibited outside shops, offices and other premises, for which separate meters are used, the rate shall be 3d. per unit.

Grimsby.—The borough electrical engineer, Mr. W. A. Vignoles, has issued a neat little pamphlet showing examples of electrically lighted shop windows, photographed at night, and emphasising the advantages of electricity. Last year the Corporation sold 46 per cent. more electrical energy than in the previous year.

Harrogate.—The E.L. Committee has recommended, in regard to small houses, that a charge of 2s. 9d. per quarter per 30-watt lamp, to be paid in advance, with a minimum of three lamps, be offered. It is proposed that the number of applications be limited to 20 existing and 20 new consumers. This latter clause was taken exception to by the town clerk, on the ground that it was illegal. The engineer pointed out that the number was limited at present because it was an experiment.

India.—Messrs. Octavius Steel & Co., of Calcutta, have recently secured the contract for an electric light installation for the Indore Residency, which is the first independent installation in India to be lit with "Osram" metallic-filament lamps. The voltage is 50, and a battery is to be provided. Among other contracts in hand by Messrs. Steel are the electric installation for Dacca College and Pusa Agricultural Institute, besides many smaller ones in Calcutta.

Kilmarnock.—The fourth annual report by Mr. A. H. Burbridge, electrical engineer to the T.C., points out that very good progress has been made with the electric lighting. The number of consumers had increased from 171 to 229, and the number of lamps connected from 15,495 to 19,680, while the number of motors had increased from 23 to 34, and the horse-power from 94 to 201. The total number of units sold had been 679,233, against 569,589 in the previous year, and the gross profit was £2,463.

London.—Bermondsey.—The town clerk has sent a further circular letter to the Metropolitan B.C.'s upon the question of the audit of the electric light companies' accounts, pointing out that Messrs. Price, Waterhouse & Co., who were the auditors of the South London Electric Supply Corporation, had been conducting an audit of that company's accounts on behalf of the B. of T., and urging that if such practice was continued it would involve very great expense to all Councils exercising in 1931 the right conferred by Parliament of purchasing the undertakings of companies in their respective boroughs.

Southwark.—The Electricity Committee of the B.C. reports that it has considered the London Electric Supply Bill and the London and Westminster and Kensington Electric Supply Companies' Bill. The Committee feels that if a general scheme for the co-ordination of the electric supply throughout London is to be carried out, a serious injustice will be done to the ratepayers, in the absence of any reservation clause being inserted in the Bills, making it obligatory to purchase such undertakings as the Southwark Council's at a fair value, and before the plant is depreciated by cheap current being forced in competition. A petition is to be presented against both Bills.

Long Eaton.—During the last financial year the U.D.C. electricity undertaking sold 662,482 units, its revenue amounting to £5,101. The net balance on the year was £522, and this with other unappropriated profits made a balance in hand of £2,950, from which £300 was applied to the general district rate. High-priced coal and poor local trade are considered to have diminished the year's profits; during the year the remainder of the public lamps have been converted from gas to electricity, and 50 c.p. metal-filament lamps (211) have been adopted for side street lighting—the whole of the streets being now lighted electrically.

Neath.—The Council has decided to borrow £18,000 for electric lighting purposes. Already it has customers for over 100,000 units annually. It is intended to connect the districts of Briton Ferry and Llansamlet, where there is a number of prospective customers.

New Zealand.—It is estimated that the profits of the Wellington electricity department, which was taken over by the municipality 11 months ago, will be £700 in excess of the previous year, although reductions in price, equivalent to £3,000, have been made. Some £13,000 has been set apart for sinking fund, interest, depreciation, &c., and £5,000 remains as net profit for the 11 months.

Redditch.—The balance-sheet of the electricity department, for the past financial year, shows a loss of £510; a great decrease took place in the demand for energy for industrial purposes due to the removal of one large concern to Birmingham. This and increased fuel costs are stated to represent a loss of £800 during the year.

Rye (Sussex).—Messrs. Foote & Milne, Ltd., have informed the T.C. that they intend applying to the B. of T. for a prov. order for E.L., and the Council has reserved the right to oppose the application if necessary.

Sedgefield.—The R.D.C. has consented to the use of overhead wires, to be protected when crossing the road, for public lighting by electricity at Chilton.

Sidmouth.—A meeting of the General Purposes Committee of the U.D.C. was recently held to interview Mr. Purves, consulting engineer, of Exeter, and confer with him on a scheme for the electric lighting of the town. Mr. Purves mentioned that when in London a short time since he discussed the matter of the Sidmouth Electric Lighting Order with the general manager of the Electric Supply Corporation, who had practically dropped the idea of establishing electric light works at Sidmouth. Mr. Purves intimated that after the encouragement he had received from the residents of Sidmouth, including its public men, he proposed to form a small local company with a capital of £9,000.

South Africa.—The negotiations between the Colonial Government and the Cape Town C.C. for the supply of electrical energy in bulk at the Table Bay Harbour Board and Railway Electric Lighting Station have now been brought to a definite conclusion. An agreement has been entered into whereby the City Council will supply a minimum guaranteed quantity of 1,250,000 units per annum, upon the basis of the average cost of coal at the rate of 1½d. per unit, the agreement providing for adjustment according to the price of coal at the time. The Council has decided that tenders be invited locally for the extensions to the boiler house plant, the two steam generators and the necessary cables, immediately. Mr. Walter F. Long, the city electrical engineer, has proceeded to Europe to arrange for ordering the additional plant (boosters, &c.) required for the proposed extensions. It is expected that a total of approximately £27,000 will be required to provide for the extensions to the plant. The agreement is for a minimum of 15 years, unless the total supply in one year exceeds 5,000,000 units, in which case the Government are entitled to give notice to determine the contract.

Stockport.—The operation of the Corporation Electricity undertaking during the year 1907-8, resulted in a gross profit of £6,319, and including £2,000 brought forward, the gross balance was £8,322, which sufficed to meet financial charges, pay over £2,000 to the rates, and carry forward a similar sum. Some 3,380,700 units were sold during the year, the tramways taking 2,260,000.

Sunderland.—At a meeting of the T.C. on the 9th inst., Alderman John Turnbull moved:—That it be an instruction to the Electricity and Lighting Committee (1) to obtain a complete independent valuation of the whole of the present plant of the electricity undertaking; (2) prepare a detailed statement of the costs of power supply to each private customer; the report to be presented to the T.C. within three months of date.—He explained that one of the reasons that had induced him to bring that matter forward was the extravagant charges made to the Tramways Committee. Mr. T. Summerbell, M.P., said they must not overlook the fact that with a company, the £70,000 set aside for sinking fund would have been available for dividend. Mr. Lawson said that the publicity caused by that resolution would mean a loss on the undertaking of from £50,000 to £100,000. The motion was lost by 24 votes to 7.

Swansea.—The annual inspection of the Corporation electricity works took place on Friday evening, when the chairman of the Electric Lighting and Tramways Committee, Mr. A. Sinclair, in proposing success to the undertaking, said they started eight years ago with a capital expenditure of £60,000, and that that sum had grown to £144,000 by the end of the last financial year. At the same time, the number of consumers had increased from 90 to 1,216, and roughly they were adding four new customers a week. The revenue showed a proportionate increase. Last year the undertaking, he was pleased to say, fulfilled all its financial obligations, and carried forward an absolute net profit of £800. New houses were being connected at the rate of 3·8 per week, and one house out of every 20 in the borough was now electrically installed.

Taunton.—At a meeting of the T.C. on Tuesday, the Electricity Committee recommended that a new double-acting engine should be purchased at a cost of £300; a Mr. Standfast complained that when the Committee came before the Council with regard to the reduction in the price of energy to the tramway company, on condition that the extension to Rowbarton took place, it stated that it would not require any extra outlay to supply the extra energy needed. He gave notice that he would move that the resolution agreeing to supply the tramway company with energy at 1·2d. per unit be rescinded, and that 1½d. be charged. The town clerk explained that the resolution could not be rescinded, as it was an agreement entered into; also this amount could not have been included in the recent loan obtained by the Committee, as it was for a renewal. The Committee's recommendation was then adopted.

Wednesbury.—A new phase in the lighting question was reached the other day, when the Corporation received notice from the Midland Power Co., who had been supplying the town with electricity for lighting and power purposes, of its intention, in consequence of the disputes which had arisen, to cut off the supply. This it subsequently did, but fortunately, the Corporation's electricity scheme was in such a forward state that when the supply of the company was stopped, the Corporation was in the happy position of being able to generate its own electricity, otherwise the action of the company would have proved a serious inconvenience.

TRAMWAY and RAILWAY NOTES.

Ayr.—The annual report of the Ayr Corporation tramway department has just been submitted to the T.C. In the statement on the tramways, the general manager, Mr. W. Grant, points out that the capital expenditure to date amounts to £82,030, and towards that sum the amount applied in reduction of debt was £1,350 from the sinking fund and £4,712 paid directly out of revenue. The depreciation and renewals fund now amounts to £11,947, and in addition there is a reserve fund of £5,000. The total revenue for the year amounted to £15,322, an increase of £38 over the previous year, the receipts per car-mile working out at 9·13d., against 9·28d. The total number of passengers carried was 3,660,038, an increase of 56,249; over 29 per cent. of the receipts were from ½d. fares.

Bath.—The London Electrobus Co. has asked permission to run six omnibuses in the city, and has in return been asked by the T.C. to send a 'bus to the city for examination and trial.

Belfast.—At the weekly meeting of the Tramway and Electrical Committee on the 14th inst., it was intimated that the Queen's Road extension was paying well, 50 workmen's cars being run morning and evening, and some additional ones would be placed on it. The draft agreement with the Clavehill and Whitewell Co., which will give running power to the latter over the Corporaton's lines, was also considered.

Brighton.—The Parliamentary Committee of the T.C. has recommended that the suspension of working of the Shoreham and District Tramways during the past three months be brought to the notice of the B. of T., with a view to determining the powers of the tramways company.

Chesterfield.—According to Mr. Acland's report on his tramway undertaking for the year 1907-8, some 2,500,000 passengers were carried, the total revenue amounting to £12,155, and the gross profit to £5,356. The net balance of £1,003 (after meeting financial charges) was added to reserve, which totals £3,027. The revenue per car-mile was 10·34d., and the working expenditure 5·78d.; the average number of passenger per car-mile was 8·68.

Continental Notes.—FRANCE.—The Monaco tramway system has been taken over by the Nice Littoral Tramways Co., and express cars will run between Nice and Mentone, stopping *en route* at Beaulieu and Monte Carlo. On the west of Nice the tramway is being extended to Antibes, joining the line through Cannes, which has also been extended 5 km. beyond Cannes to La Napoule. This gives some 50 miles of tramway route along the sea shore, extending westward from the Italian frontier, and on the Italian side an English company is pushing on with further tramways. The various tramway companies are also constructing branches to the principal inland towns in the vicinity with a view to developing both tourist and merchandise traffic.

GERMANY.—A somewhat novel motor fire engine has lately been added to the Fire Brigade equipment at Wilmersdorf, near Berlin. The machine, which was built jointly by Messrs. Gottfred Hagen, of Kalk, Cologne, and Messrs. Flader, of Johstadt, is electrically propelled, and carries a vertical boiler, engine and pump for pumping purposes. The vehicle is provided with a battery of 40 cells, one charge of which enables it to run a distance of from 15 to 17 miles at a maximum speed of 19 miles per hour. Two electric motors are used, these being mounted on the hubs of the front wheels.

It was reported last week that the firm of Siemens & Halske had been commissioned to build an electric railway line between Berlin and the suburb of Schöneberg.

Plans are being prepared in respect of a projected electric tramway in the town of Gummersbach.

Dundee.—The tramway extensions are being pushed on, and from Craig Pier entrance past the Tay Bridge and west stations the line has been completed. When finished the new route will fill a much felt want, and add considerably to the tramway revenue.

On the afternoon of Wednesday, last week, the car service was restricted to allow as many of the men as possible to attend the tramwaymen's sports.

Hythe (Kent).—A curious situation has arisen respecting the proposed tramway scheme. A few weeks ago the T.C. approved of the overhead system being adopted instead of the Dolter system. A poll of the ratepayers resulted in this decision being acquiesced in by a majority of 44 votes, but the Corporation on September 9th decided by 11 votes to 5 not to sanction the overhead system. Thus the matter is left at a deadlock.

Kilmarnock.—The returns of the tramways for the year 1907-8 show that during the year 306,170 car-miles were run, against 328,829 in the previous year, while the passengers carried numbered 2,296,261, against 2,331,277; the receipts from passengers amounted to £8,007, compared with £8,245 last year. Bad trade is blamed for the reduction. The receipts per car-mile had risen from 6·00d to 6·33d., due to fewer miles having been run. There is now a net deficit of £1,852 on the undertaking.

Kirkcaldy.—During the last six months the traffic receipts on the tramways have averaged 1d. per mile higher than those of the same period of the previous year, which gives a net result of £767 to the good during the six months. This improvement is believed to be due to the working arrangement come to with the Wemyss Tramways Co., whereby the wasteful blanketing of the Wemyss cars alongside the Corporation cars was got over. Kirkcaldy, it should be noted, is the only town of its size in Great Britain which has adopted with success long universal ½d. stages throughout its whole system. An extension of the tramways to Dysart is strongly recommended.

London.—ST. PANCRAS.—A Joint Committee, which has been negotiating with the L.C.C. in regard to the electrification of the tramways from Euston Road to Holloway, has (subject to the usual sanction) approved the plans conditional upon the wood paving being retained in the tramway tracks in Hampstead Road and High Street, Camden Town. There are some small matters which are still the subject of negotiation.

New York.—According to the *Times*, an accident occurred on the Elevated Railway in Brooklyn on the 12th inst., through one train running into the rear of another, which was held up by a fire on the line. The driver of the train was killed and many people were injured.

Southampton.—After a long discussion on the proposal to extend the tramways to the pier, it has been decided to refer the matter back for estimates as to probable cost of construction and working.

Southport.—The T.C. has declined to entertain an application from the London Electrobus Co. for a licence to run a service of electrical 'buses in the borough. The granting of the application would result in competition with the Corporation tramways.

Sunderland.—Two motor-generators at Messrs. Laing's works are to be removed to the Dunning Street station, and a new 600-KW. rotary converter is also to be installed, the object being to run the whole of the tramways from Hylton Road Station, as the latter has proved much more efficient in working.

Twickenham.—The U.D.C. recently laid before the Chief Commissioner of Police complaints of a nuisance caused by the noise of the cars on the London United Tramway system in various parts of the district. A reply has been received explaining that the nuisance was almost entirely attributable to the condition of the track over which the cars ran. It was found by careful watching that there was no preventable noise from the cars running over a track which was free from corrugation.

York.—At the half-yearly meeting of the York Tramways Co. on the 9th inst., the chairman *pro tem.* (Mr. W. H. Thackwray) referring to the taking over of the system by the Corporation, said that Mr. H. G. Simmonds, director and secretary, had been in communication with the B. of T. about the matter, and was informed that the Order had been settled on behalf of the department, and only awaited the completion of certain formalities before receiving confirmation. He hoped the Corporation would, in the course of time, take over the system and relieve the company.

TELEGRAPH and TELEPHONE NOTES.

Pacific Cable.—The report of the Pacific Cable Board to the Treasury for the year 1907-8, which was issued last week, showed traffic receipts £109,637, interest on deposits £522, and expenditure £172,522; of the deficit the United Kingdom paid £17 322, Canada the same, Australia £20,787, New Zealand £6,929. The gross traffic receipts for the 12 months were £2,852 less than for the 13 months included in the previous year's returns, the extra month accounting for most of the difference; there was an increased expenditure of £4,083. The cable worked without interruption or repair throughout the year. Last year 105,189 messages of 1,230,345 words were transmitted, as compared with 1,128,662 words in 1906-7, and 922,766 words in 1905-6. An important local traffic between Australia, New Zealand and Fiji keeps the southern sections of the cable fully occupied.

Telegraph Rates.—At the Conference of the Association of Chambers of Commerce at Cardiff this week, a resolution was passed urging the reduction of foreign and Colonial rates, a tariff of 1d. per word being suggested for France, Belgium, Holland and Germany. Some wild statements were put forward regarding the maximum capacity of the Atlantic cables and their actual traffic, the arguments of Mr. Henniker Heaton being quoted. One member objected to any reduction in the cost if it were likely to interfere with the efficiency of the service, and stated that he had to send cable messages *via* New York for quick delivery at Havre.

Telegraphic Interruptions and Repairs:—

	Cables.	Interrupted.	Repaired.
Curacao-Coro Curacao-La Guayra Curacao-Maracaibo	Closed	Jan. 12, 1908 ..	..
Tarifa-Tangier		Jan. 18, 1904 ..	..
Port Arthur-Chifu (Closed)		Mar. 9, 1904 ..	..
Las Palmas—Arrecife		May 18, 1908 ..	..
Pera-Dardanelles		May 20, 1908 ..	..
Sierra Leone-Accra		May 28, 1908 ..	..
Djedda-Souakim		July 27, 1908 ..	..
Asaab-Massouah		July 28, 1908 ..	..
Cadiz-Teneriffe		Aug. 20, 1908 ..	Sept. 10, 1908.
Cotonou-Lagos		Aug. 29, 1908 ..	..
Paramaribo-Cayenne		Sept. 3, 1908 ..	..

Telegraphists' Grievances.—At the Trade Union Congress last week a resolution was passed protesting against the employment of ex-soldiers and sailors as telegraph operators, at lower wages than those received by established telegraphists. The recommendations of the Hobhouse Committee, advocating an extension of hours from 48 to 50½ in some branches, and the exclusion of future entrants as skilled mechanics from the benefits of sick and holiday pay and medical attendance, were condemned, a protest against the practice of permitting newspaper proprietors and news agencies to provide their own operators for transmitting news telegrams was formulated, and the removal of the civil disabilities of Civil Servants was called for.

Telephone Charges.—Some interesting correspondence has taken place between Mr. C. Lancaster, chairman of the Liverpool Chamber of Commerce, and the Postmaster-General on the subject of telephone tariffs. Mr. Lancaster is an advocate of the measured-rate system, and has evidently investigated the matter thoroughly. Addressing the P.M.G. in the first instance, he inquired whether the Government could give a total of 10,000 outward calls for £10 per annum at a profit or without loss. Mr. Buxton replied that to do this would certainly involve a financial loss, while a line originating that number of effective calls in ordinary business hours would be overloaded, owing to the number of inward calls that would find the line engaged. He pointed out also that at present, with a much smaller average of calls, 25 per cent. of the calls made on exchange systems in the larger towns were rendered ineffective mainly by the overloaded condition of the lines of a limited number of large users.

Mr. Lancaster then asked whether 5,000 calls per line would be a reasonable number, and would leave a moderate profit. Recognising the fact that the telephone business differs from others in that the cost and complexity of the system increase far more rapidly than the number of subscribers connected, he discussed the measured rate in the light of the National Telephone Co.'s last balance-sheet, deducing the proposition that with a charge of £5 per line and ¼d. per local call, 1d. per junction call and certain mileage charges for distant subscribers, an annual revenue of £417,000 could be obtained. The flat-rate service, he said, had been grossly abused by thousands of subscribers, and so, no doubt, it has. On the basis which he suggested, 1,000 calls would cost £6 0s. 10d.; 5,000 calls, £10 4s. 2d.; and 10,000 calls, £15 8s. 4d. These figures are the average for the whole country; for London a higher tariff would be obligatory owing to the greater cost of the service, and this would increase the total revenue beyond the amount stated. Further correspondence followed, in which Mr. Lancaster proposed modifications in favour of the small user. In his reply, Mr. Buxton remarked that 5,000 originated calls per annum would make up a full load for the line of an average subscriber who received as many calls as he originated, mainly during the busiest hours, and he expressed his willingness to consider proposals which might lead to an equitable working arrangement.

At the Conference of the Association of Chambers of Commerce, at Cardiff, on Tuesday last, the chairman of the Telephone Committee, Mr. A. J. Hobson, remarked that two members who, it was found, were shareholders of the National Telephone Co., had been asked to withdraw from the Committee, as their presence might lead to embarrassment in the deliberations of that Committee. He then moved the adoption of the report of the Committee, and the appointment of a new committee to continue the negotiations. The two members in question—Mr. F. Faithful Begg, London, and Mr. C. Lancaster, Liverpool—moved and seconded an amendment, the latter condemning the flat rate and protesting against his exclusion from the Committee. The amendment later was withdrawn and the interim report of the Committee adopted. T new Committee did not include Mr. Begg and Mr. Lancaster. was resolved that representations should be made to the Postmaste General deprecating any increase of rates until Parliament ha considered the matter, after investigation of the National Telephon Co.'s books and accounts.

Theft of Telegraph Wire.—Last week James Harrigan and Thomas Harrigan were indicted for stealing a quantity of copper telegraph wire, the property of the Postmaster-General, near Carlton Bridge, Westbourne Park. It was stated that the telegraph line had been cut on about 60 different occasions, the damage done amounting to £350. The Recorder sentenced James Harrigan to three years' penal servitude and Thomas Harrigan to six months' imprisonment with hard labour.

Wireless Telegraphy.—According to the United States Consul at Tahiti, it is proposed to establish wireless communication between nearly all the groups of islands in the South Pacific, and to include in the system Australia, New Zealand and other important stations. A capital of £70,000 is suggested, of which £10,000 has been provided by the owners of phosphate deposits on Ocean and Pleasant Islands.

THE WORKS OF ERCOLE MARELLI & CO., MILAN.

It is probable that the average English reader has little idea of the industrial development of Italy, for that country while familiar to the tourist and traveller, is but little in evidence in this country so far as its manufactures are concerned.

Northern Italy, however, possesses a fully developed textile and engineering industry, with Milan as headquarters.

The electrical industry is represented by many well-known firms, amongst which will be found Messrs. Ercole Marelli & Co., whose extensive works (fig. 1) are situated at Sesto San Giovanni, a picturesque village, some four miles distant from Milan.

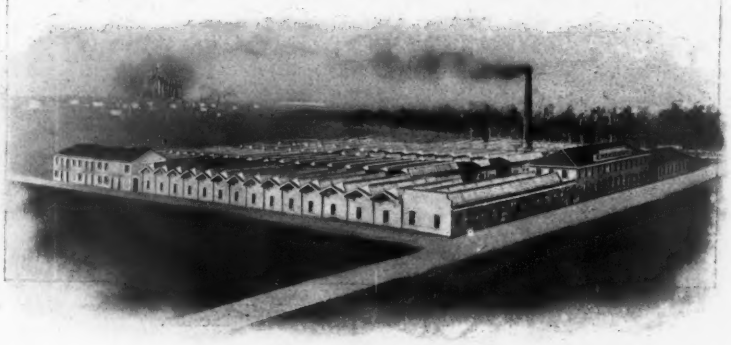


Fig. 1.—Messrs. Ercole Marelli's Works, near Milan.

In an incredibly short time he was so successful that he became one of the leading men in the trade, and began to manufacture small electric motors and fans, which up to that time had been imported into Italy from other countries. The progress made can best be gauged from the fact that at the commencement of his career Mr. Marelli had only one lad to assist him, and occupied premises of about 30 sq. m. area, whereas his present factory covers an area of nearly 50,000 sq. m., and he employs over 800 workmen, and a clerical staff numbering 75.

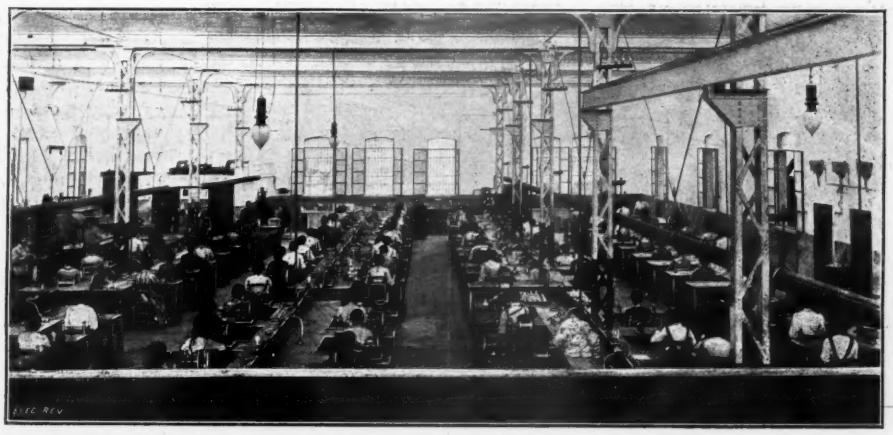


Fig. 2.—View in the Coil-Winding Department.

Fig. 3.—General Machine Shop for Small Fans and Ventilators.

Some 18 years ago Mr. Marelli started in business with little capital as a manufacturer of small electric apparatus for medical purposes, electric bells and other small goods.

During the year 1907 the output of the firm exceeded 100,000 electric fans and small motors. But this does not represent the entire scope of the work, as there is also an

important "Industrial section," which is exclusively devoted to the manufacture of all kinds of motors up to 100 H.P., exhaust fans, blowers, &c., and in this department an exhaustive study of various systems of ventilation is made.

A very large export business has been built up, and last year over 40,000 fans were exported to various parts of the world, including Central and South America, India, Egypt, Japan, China, Australia, Canada, and many European industrial countries, including England.

Fig. 4.—View in the "Industrial" Section.

As an instance of successful business, it may be mentioned that, taking the available statistics for the importation of fans into South America, about 80 per cent. are the products of this firm.

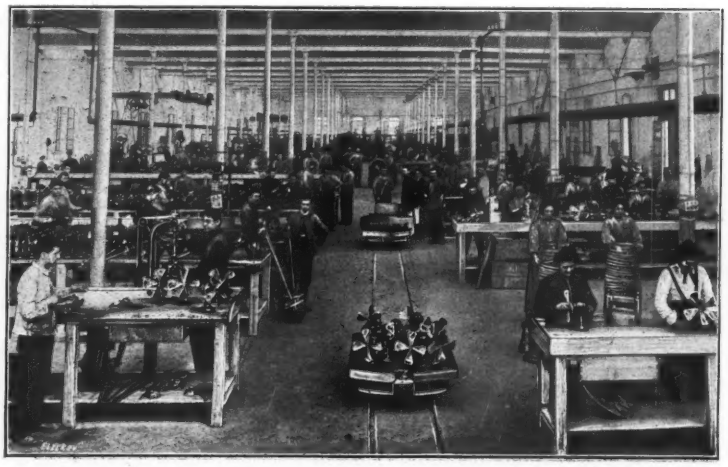


Fig. 5.—The Assembling Department for Small Fans, &c.

Owing to the ever-increasing demand for export to the East, especially during the past year, the firm has carefully studied the question of the winding and insulation of the armatures and field coils of its fans, and has perfected a special process by which its goods are enabled to withstand action of any climate.

Although the different patterns of fans number only about 30, each pattern is sub-divided into about 10 different types for direct current and 42 for alternating current, which gives a total of about 1,500 types.

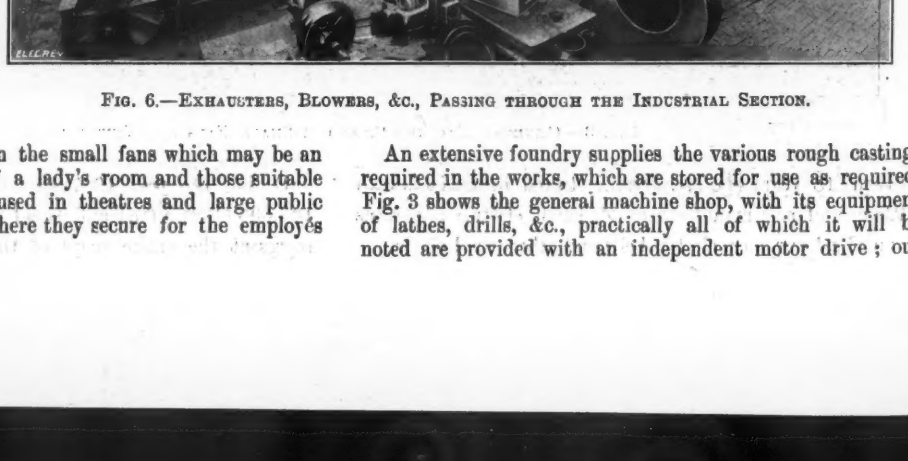


Fig. 6.—Exhausters, Blowers, &c., Passing through the Industrial Section.

These vary in size, from the small fans which may be an ornament on the table of a lady's room and those suitable for office use, to those used in theatres and large public buildings and factories, where they secure for the employés more hygienic conditions.

Manufacturers who have used electric fans and studied the ventilation of their premises, have found that the productive power of their workmen has considerably increased. It is easily understood that in buildings where large numbers of people are employés, or where chemical substances are manufactured, good ventilation ensures a supply of fresh air, which is most important for the workmen.

All these necessities Messrs. Marelli have provided for by means of their fans, which vary in size from a 10-in. desk fan to a 60-in. ceiling fan.

The organisation of the works is very complete, and the operations are divided in such a manner that each man is a specialist in the work he does.

It is interesting to note that, despite the large amount of repetition work—the fans being normally constructed in batches of 200 at a time—the majority of the workers are paid by time, and piece work is but little favoured.

The factory is divided into two distinct sections, one for the desk and ceiling fans, the other (called the Industrial section), which undertakes the construction of the largest exhausters, blowers, motors and transformers, and the carrying out of various schemes of ventilation. The former is the more important department.

Electricity is used for motive power and lighting throughout, a three-phase supply at 600 volts and 42 cycles being obtained from the public mains, and subsequently transformed down to suitable pressures.

An extensive foundry supplies the various rough castings required in the works, which are stored for use as required. Fig. 3 shows the general machine shop, with its equipment of lathes, drills, &c., practically all of which it will be noted are provided with an independent motor drive; our

illustration shows clearly the numerous fan and ventilator castings in process of machining, and which subsequently pass on to the assembling department, shown in fig. 5. Another section of the works is devoted to the stamping and insulating of the core plates used in the stators and rotors.

The winding department, shown in fig. 2, is operated entirely by female labour; all the armature and field coils are wound on automatic machines, and are subsequently impregnated with insulating varnish and dried off in electric stoves at a very high temperature. Messrs. Marelli claim that their insulation is of a specially robust character, and that its ability to withstand extremes of temperature and moisture has been proved by experience.

A separate department is reserved for the fitting of lubricating apparatus, and the fan when complete, passes to the mounting department, and receives its distinctive finish of enamel, nickel, &c.

Fig. 9 shows the testing department, where the majority of the fans and ventilators undergo a 12-hours' trial; usually some 500 large and small fans are to be found in this department, from which they are, if satisfactory, passed into the finished stores, shown in fig. 8.

In the industrial section the variety of work carried out is considerable, but here, also, the division of labour is strictly observed, so that each man is a specialist in the work which he performs. In fact, all the products of this section are the work of expert workmen. Figs. 4 and 6 are views in this section of the works.

From this department are sent all the exhausters which this firm manufactures, varying from 9 in. to 70 in. diameter, also blowers of various kinds, such as for gas furnaces, and heating and drying systems, and also for collecting dust and refuse.

The "Marina" type, designed for the ventilation of vessels, has been adopted by the Italian Navy, and is a speciality of the firm; and the "Lamiera" type, which is made entirely of cast-iron plates, is largely used for the ventila tion of mines of all kinds. All the types are suitable for special purposes, too varied to enumerate.

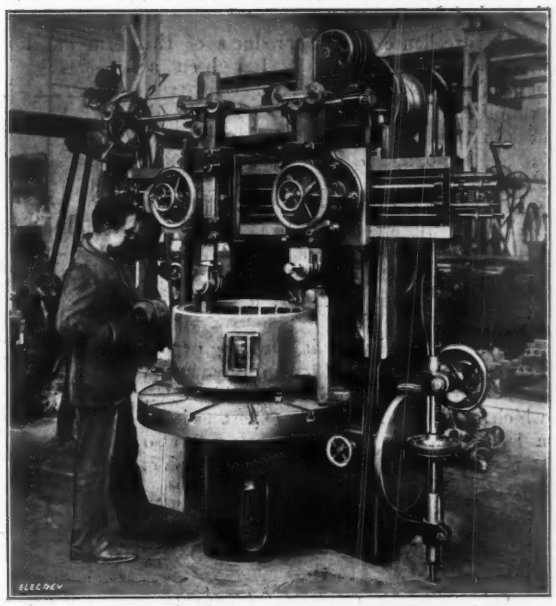


Fig. 7.—Electrically-Driven Vertical Boring and Turning Mill, Industrial Section.

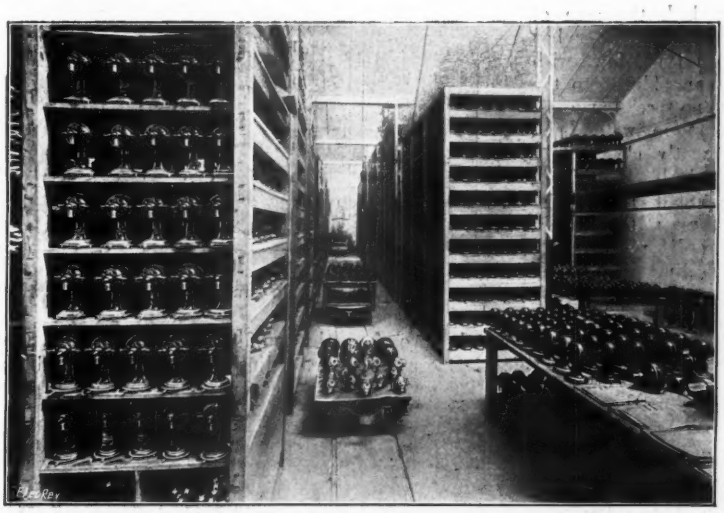


Fig. 8.—View in the Finished Stores.

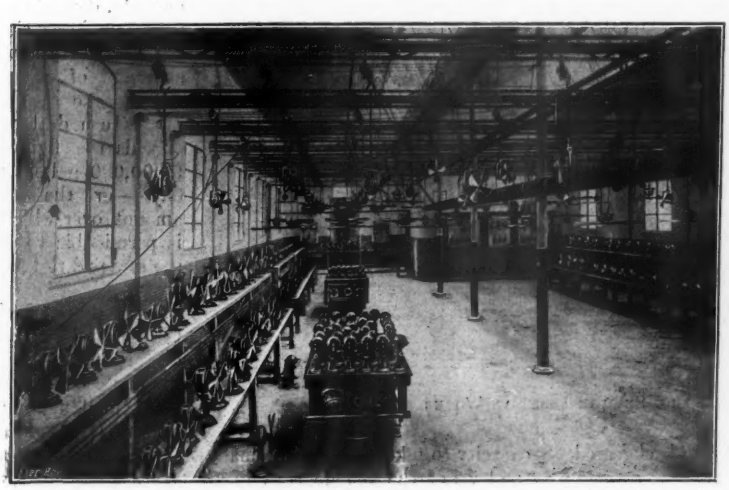


Fig. 9.—The Test Room.

Messrs. Marelli make a speciality of ventilating fans for glass works, and we understand that 99 per cent. of the numerous Italian glass works have been equipped by them, the fans and motors having given no trouble, in spite of the high temperature in which they necessarily work. Another kind of ventilating installation was that supplied to the Milan post office, where five large blowers are installed for circulating hot air in the winter and cold air in the summer throughout the building.

In concluding this article, we may remark that in addition to an excellent industrial organisation, this firm has a well developed business department.

Its catalogues, which are published in several languages, are well illustrated, and may be found in every part of the world.

The initiative of the founder of this business ensures that not only will the fans be useful, but that their appearance shall be artistic and elegant, and with this object in view he organises special competitions and awards prizes for the best designs submitted for approval.

A feature which is specially worthy of note is the attention which is bestowed on the welfare of the workers; dining rooms are provided in the works, and houses have been

specially built for the use of the chief workmen in the vicinity of the works.

The excellence of the products of this firm has been widely recognised, and it has been a successful exhibitor at several important exhibitions, having been awarded the gold medal at the Earl's Court Exhibition some few years ago, and the Grand Prix at the Milan Exhibition of 1906.

Branches have been established in all the principal towns of Italy and in Paris and Berlin, and representatives are to be found in Amsterdam, Brussels, Madrid, Moscow, Lisbon, Cairo, Buenos Ayres, and Rio de Janiero.

In order to deal with its growing export business to the East, a London branch has been opened at 26, Garlick Hill, E.C., which deals specially with export orders; a large variety of fans and motors is also stocked for the purpose of executing orders for the English market.

CARLISLE CORPORATION SEWAGE DISPOSAL SCHEME.

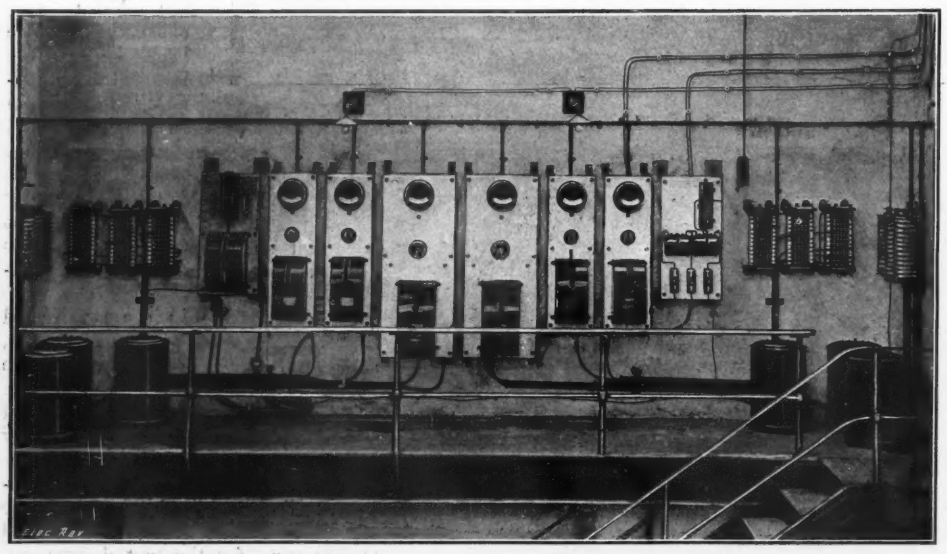
The sewage disposal scheme, of Carlisle, originally consisted of a screen house accommodating two small hand-worked screens and one filter bed, the area of which was 1,600 sq. yd. The filter bed was of the ordinary open type, filled with granite chippings, with an effluent to the river Eden. There was no special arrangement for dealing with storm water, and the effluent was not exactly clear. The present scheme for which the Local Government Board granted a loan of £50,000, consists of three settling beds, six filtration beds for ordinary use, with four extra beds for dealing with storm water. The total area of the filtering beds is now about two acres.

The main sewers are brought to three penstocks, two of which lead to screening chambers, and the third, by means of a storm channel, direct to the suction chambers. The screens and their conveyors, are driven by means of two backgeared 6½ h.p. British Westinghouse motors.

The sewage passes to the pumps, which lift it about 25 ft. to a main reception chamber, and from there it is distributed to the sedimentation beds, and in turn to the filtration beds, or in the case of storm water, to the sedimentation beds and thence to the storm filtration beds. The difference in the two filtration beds is that the sewage is sprayed out over the ordinary, whilst it flows in bulk on to the storm beds.

View showing the Electrically-Driven Sewage Pumps.

There are three pumps in duplicate, of the following capacities: 1,440,000, 3,168,000 & 6,048,000 gallons per day, driven by 16, 30 and 57 h.p. direct coupled Westinghouse shunt-wound motors. The two sets are to be used alternatively, depending on the screen house cleaning, &c. The total amount of sewage which one set of pumps can deal with exceeds the figure of 9,000,000 gallons per day — or the storm amount over which it is permissible to open the sewers direct to the river.



The Switchboard, Carlisle Sewage Disposal Works.

It is proposed that the control shall be carried out by means of floats. A small motor and pump is of sufficient capacity to take care of the smallest flow; when, however, the level of the sewage rises in the suction chambers, and the small set becomes unable to deal with it, a medium sized pump is brought into action. The arrangement of floats is

such that both pumps will then run together until the level is reduced a certain distance, when the small pump cuts out; the medium pump will continue running by itself until a still lower level is reached, when it in turn will be automatically switched out. Should, however, the level gain, in spite of the small and medium pumps, the largest pump starts and runs until the three have reduced the level, thus cutting out the small, the medium, and the large pumps successively.

The switchboard, consisting of one lighting panel, one power supply and six motor panels, was built and erected by the British Westinghouse Co.

The supply system necessitated some careful consideration as a duplicate arrangement was asked for, and the distance between the power station and the sewage works was about 1½ miles. Finally it was decided to lay two ·15 cables to run in parallel for the high-pressure side, and one ·2 cable for the negative or earth potential cable (the supply being taken off the traction bars normally). Change-over switches are provided at either end enabling the polarity of the supply cables to be reversed in the event of a breakdown occurring, the section of the two parallel cables being such that in case of absolute necessity the pressure drop would not be too prohibitive to allow of a supply being taken off the ·2 and one ·15 cable only. In this manner, practically duplicate underground work is provided at a minimum cost.

The fibre type of conduit (Key Engineering Co.) was selected as the most suitable, and of this, four ways of 2 in. inside diameter are provided throughout, leaving one spare way in case of necessity. One 3-in. pipe was also laid to about half way from the power station, for an extension feeder which will shortly be required, and a fifth 2-in. pipe was laid from the half-way point to the sewage works for a three-core lighting cable. The sleeve type of conduit was used for the 2-in. size, and the socket type with compounded joints for the 3-in. conduit. The pipes are embedded throughout in good stiff concrete giving one inch protection on all sides. The cable contract was carried out by the British Insulated & Helsby Cables, Ltd., and included drawing the cables into pipeways, laid by the Corporation.

It is anticipated that about 2,500 units per week will be required. To be able to deal with this load at any time, the power cables are connected across the terminals of a battery and reversible booster set. This set is used on traction normally, but can also be switched on to the lighting bars if required.

The erection of the whole of the pumping plant was carried out by Mr. Zimmer, Messrs. Gwynne's engineer. The Corporation Electrical Engineer arranged the supply system, carried out the subsequent tests and supervised the electrical part of the scheme. On the official tests the guaranteed overall efficiencies given below were all exceeded:

Pump size.	Motor H.P.	Guaranteed efficiency.
14 in. ...	57 ...	65 per cent.
10 in. ...	30 ...	61 „
7 in. ...	16 ...	59 „

The Cost of Electric Train Lighting.—A recent paper before the Western Railway Club (U.S.A.) contained a comparison of electric train lighting systems, with advantage to the so-called head-end system, in which small turbo-generators are mounted on the locomotive for supplying the train. According to data given, such an equipment for a 16-car train (including two 25-KW. Curtis turbo-generators; switchboards; four sets of storage batteries—each of 54 cells, 240 ampere-hour capacity; wiring, &c.) would cost $13,988, or an average per car of $874. A storage battery system (with 16 sets—each of 32 240-ampere-hour cells, wiring, &c.) for a 16-car train, would cost $17,176, or an average per car of $1,073. The axle dynamo system for a similar 16-car train (generators, regulators, batteries, &c.), would cost $26,776, an average of $1,673 per car. But it is not only in first cost that the head-end system excels, according to this authority, as the operating cost in its case is given as $8,530, as compared with $9,593 and $10,101 respectively for the straight storage and axle dynamo systems. The operating cost is made up of cost of energy, haulage, interest and depreciation, attendance, lamp renewals, oil, waste, repairs, &c., and the energy consumption per round trip, is estimated at 290 KW.-hours.

Zanzibar.—The Post Office announces that telegraphic communication has now been opened with the Island of Pemba, Zanzibar.

CONTRACTS OPEN and CLOSED.

OPEN.

Australia.—ADELAIDE.—November 20th. The City Council requires tenders for the supply and erection, complete, of a refuse destructor, electric lighting plant for same, &c. Particulars may be obtained from the Agent-General for South Australia, 1, Crosby Square, Bishopsgate Street Within, E.C.

TASMANIA.—November 2nd. Tenders will be received at the office of the Deputy Postmaster-General, Hobart, for the supply and delivery at Hobart of material for accumulator equipment for telegraph purposes. Tender forms, specifications, &c., may be seen at this office.

SOUTH AUSTRALIA.—October 21st. Tenders will be received at the office of the Deputy Postmaster-General, Adelaide, for a power plant for charging accumulators for telegraph purposes at the General Post Office, Adelaide, as per specification No. 228. Specifications can be seen at this office.

October 19th.—Four sets of instruments for direct duplex cable working, for the Postmaster-General's department. See "Official Notices" September 11th.

MELBOURNE.—The Postmaster-General of the Commonwealth requires tenders for supply and erection of installations for wireless telegraphy at the following places:—Launceston; King Island (Bass Straits); Flinders Island (Furneaux group); Melbourne. See "Official Notices" to-day.

MELBOURNE.—City Council. 770 meters and 157 indicators, estimated at £2,144, are required by the Electric Supply Committee.

Belgium.—October 2nd. The municipal authorities of Malines are inviting tenders for the concession for the supply of electricity in the town for lighting and power purposes. Particulars may be obtained from, and tenders are to be sent to, Le Collège Echevinal, Hôtel de Ville, Malines.

Blackpool.—September 19th. 100 tons of steel rails, 30 cwt. of fish-plates, 20 cwt. of tie-bars, and about 300,000 hardwood paving blocks, also taking up and relaying about 823 lineal yards of double-track tramways, for the T.C. John S. Brodie, Borough Engineer, Town Hall, Blackpool.

Egypt.—October 29th. The Ministry of the Interior wants tenders for the installation of electric lighting in the town of Zagazig, in accordance with specifications and plans that may be inspected at the offices of the above Ministry at Cairo.

Germany.—The municipal authorities of Flonheim (Rhenish Hesse) are about to invite tenders for the establishment of a central electricity station, at an estimated cost of £40,000, to supply 18 places in the district.

Halifax.—September 29th. Electrical fittings for six months for the B.G. A. T. Longbotham, Clerk, 4, Carlton Street, Halifax.

Ilford.—September 22nd. Overhead travelling crane for the U.D.C. See "Official Notices" September 4th.

London.—October 13th. Six fuel economisers, 320 tubes each; three electrically-driven feed pumps, 9,000 gals. per hour each; and two 5,000-KW. horizontal steam turbo-generators, for the L.C.C. See "Official Notices" to-day.

Merthyr Tydfil.—September 19th. Messrs. Hills, Plymouth & Co., Ltd., invite tenders for stores for electric appliances for their collieries for 12 months ending September 30th, 1909.

Plymouth.—The Electricity Committee of the T.C. has empowered the electrical engineer to purchase a centrifugal pump to replace a pump which is worn out.

Salford.—October 5th. Electric wiring of the Halton Bank Council School, Pendleton, for the Salford Education Committee.

Saltley.—September 25th. Three-phase induction motor (200 H.P.) for direct coupling to a centrifugal pump for the Birmingham, Tame and Rea District Drainage Board. See "Official Notices" to-day.

Spain.—October 10th. The municipal authorities of San Mateo (province of Castellon) are inviting tenders for the concession for the electric lighting of the town during a period of 10 years. Conditions may be obtained from, and tenders are to be sent to, El Secretario del Ayuntamiento de San Mateo (Castellon).

Taunton.—The T.C. requires tenders for a 150-B.H.P. compound condensing engine, for coupling to a generator.

Watford.—October 6th. 500-KW. turbo-alternator, surface condenser, switchboard panel, economiser and high-speed fan engine for the U.D.C. See "Official Notices" to-day.

CLOSED.

Australia. — ADELAIDE. — Postmaster-General. Telephones, switchboards and cable :—

300 magneto wall sets, £52 10s. each.—J. Bartram & Son.
Three switchboards, each for 100 metallic circuit lines, at £52 6s. 2d. each; 5½ miles lead-covered cable, 208-pair (12½-lb. conductors), at £486 per mile; 5 miles lead-covered cable, 78-pair (20-lb. conductors), £80 per mile; 900 yards light lead-covered cable, 104-pair, £184 12s.—British Insulated and Helsby Cables, Ltd.
3½ miles lead-covered cable, 156-pair (12½-lb. conductors), at £389 per mile; 8½ miles lead-covered cable, 104-pair (12½-lb. conductors), at £284 10s. per mile.—Western Electric Co.
2 miles lead-covered cable, 78-pair (12½-lb. conductors), at £229 per mile; 4 miles lead-covered cable, 52-pair (12½-lb. conductors), at £175 per mile; 2 miles lead-covered cable, 26-pair (20-lb. conductors), on ½-mile drums, at £132 per mile.—W. T. Henley's Telegraph Works Co., Ltd.

Edmonton.—At their last meeting the Guardians of the Edmonton Union had under consideration 42 tenders which had been submitted, to the specification of Messrs. May & Hawes, the consulting electrical engineers, for the electric lighting installation of the nurses' home, when the tender of Messrs. Tilley Bros., of Kingsland Road, London, amounting to £376, was accepted. This is the first section of a large extension scheme which the Guardians are carrying out in connection with the new infirmary. The specification for the electric lighting of the infirmary itself will be issued in a few months' time.

France.—The French Post and Telegraph authorities in Paris have just placed a contract with La Société Industrielle des Téléphones, of Paris, for 150 kilometres of submarine telegraph cable core, at £54 per kilometre.

Gainsborough.—The T.C. has accepted the tender of Messrs. Meldrum Bros. for a refuse destructor, at £2,197.

Glasgow.—Messrs. W. C. Martin & Co., of Glasgow, have secured from the Orient Steam Navigation Co. the contracts for the electrical installations of three of the five new liners at present building for their Australian mail service. The remaining two will have installations by the builders. Messrs. Martin & Co. are also to fit with electric lighting and other apparatus the large tram ferry which is building at Walker-on-Tyne for the Swedish State Railways.

Heckmondwike.—The U.D.C. has accepted the tender of Messrs. Henley's Cable Co. for the supply of cable for the extension to the Co-operative Wholesale Society's premises.

Lancaster.—The order for the fittings for the new Town Hall has been placed with Messrs. Veritys, Ltd., by the contractors, Messrs. Calvert & Heald, Lancaster.

Leek.—The U.D.C. has accepted tenders as below :—

CABLES.			WIRING STATION EXTENSION.		
Callender's Co. ..	(accepted)	£88	**E. Phillips**	(accepted)	£19
Glover & Co.	..	38	M. Carding & Sons	..	23
Edison & Swan Co.		43	J. Richards		25

London.—The Metropolitan Asylums Board has received the following tenders for the installation of a storage battery, booster, switchboard and connections on board the training ship *Exmouth* :—

		£302
Johnson & Phillips, Ltd.	(accepted)	
General Electric Co.		304
Pinching & Walton		307
G. E. Taylor & Co.		311
Union Electric Co.		312
Cox-Walkers, Ltd.		325
Watford Engineering Works		327
Nursey & Marr		345
Whipp & Bourne		352
Edmundson's Electricity Corporation		354
Dargue, Griffiths & Co.		365
Millwall Electric Co.		375
Pritchetts & Gold		382
D.P. Battery Co.		406
Electric Construction Co.		409
W. Harvie & Co.		410
Crompton & Co.		415
Premier Accumulator Co.		415
Chloride Electrical Storage Co.		450
Siemens Bros. Dynamo Works		485
Electrical Power Storage Co.		487
C. Pullan		499
Hart Accumulator Co.		521
R. Pope, Ltd.		555
S. Newton & Co.		715

(The engineer-in-chief's estimate was £300.)

The Westminster Electric Supply Co., Ltd., have, on the advice of their engineers, Messrs. Kennedy & Jenkin, placed an order for five surface condensers for their new power station in Horseferry Road in the hands of Messrs. Willans & Robinson, Ltd., Rugby, at £7 073.

STOKE NEWINGTON.—The B.C. has accepted the tender, at £47, of Messrs. James Keith & Blackman Co., Ltd., for an electric fan and case and air trunk for ventilating the electricity generating station.

ST. PANCRAS.—The B.C. has accepted the tender of Messrs. Dorman, Long & Co., at £66, for strengthening the stanchions of the old building in the King's Road generating station.

Nassau.—A contract has been placed with Messrs. Crompton & Co., Ltd., by the Crown Agents for the Colonies for the electric lighting of the city of Nassau, capital of the Bahama Islands. The consulting engineers are Messrs. Preece & Cardew, and the contract includes the supply and erection of all station plant, machinery and mains. The plant will consist of three 81-B.H.P. Y.E. type Crossley gas engines and suction producer plant, the engines being direct coupled through flexible couplings to three of Messrs. Crompton's standard continuous-current interpole dynamos, each capable of developing 45 KW. at 200-220 volts when running at a speed of 200 revs. per min. All the necessary circulating water pipes, two electrically-driven centrifugal pumps for circulating the water, a balancer set, dealing with an out-of-balance current of 100 amperes in the middle wire, and a switchboard for the control of the three dynamos, balancer and feeders, will be supplied. The mains will consist of overhead bare copper conductors carried on steel cross-arms mounted on wooden poles, on which brackets will also be mounted for carrying the incandescent lamps for street lighting. The contract includes the running of all service mains to consumers. The system of supply will be three-wire continuous current, 100 volts for lighting and 200 volts for power. We understand that the erection will commence about the beginning of October.

Plymouth.—The Electricity Committee has accepted the quotation of Messrs. G. M. Boddy & Co. to supply metal-filament lamps, at 4s. per lamp, less 25 per cent. and 5 per cent. The quotation of the British Thomson-Houston Co., Ltd., to supply carbon lamps, at 6d. each for 5, 8, 16 and 25-C.P. lamps, and 9d. each for 32-C.P. lamps, was also accepted.

Sunderland.—The T.C. has accepted the tenders of Messrs. Crompton & Co., Ltd., and the Oliver Arc Lamp Co., Ltd., for the supply of arc lamp carbons.

Swansea.—The T.C. has accepted the tender of Messrs. Glasbrook Bros, Ltd., for the supply of small steam coal (Garngoch) for 12 months.

Wimbledon. — The General Electric Co., Ltd., has received a contract for 1,300 high voltage "Osram" lamps for street lighting at Wimbledon.

CONTRACTORS' COLUMN.

[The following information is published in the interests of electrical contractors and others who are seeking for openings for new business. Considerable expense is incurred in the production of this column, and every care is taken to ensure that the information is new and accurate, but it will be understood that in a matter where so many correspondents are engaged, and where the amount of information to be handled is very large, this cannot always be guaranteed. If alleged inaccuracies are reported to the Editors, they will be fully investigated.]

ABERDEEN.—Reconstruction of Skene Street Public School. J. A. D. Allan, architect to the School Board. Organ factory in Arddarroch Road, for E. H. Lawton, organ builder.

ACCRINGTON.—Houses, Queen's Road, for Richard Stewart; Whittaker Street, for James Dixon; greenhouse and motor-house, High Lea, Whalley Road, for James Cunliffe, J.P.

ADLINGTON (near CHORLEY).—New Church of England Schools (£3,000). Rev. T. H. Minett, vicar.

ARBROATH.—Extension of premises for High Street Co-operative Society. Hugh Gavin, architect, Arbroath.

ASCOT (SUNNINGDALE).—Mansion on the golf links, for H. Wills, "Morings," Sunningdale. House on Ridgemount Estate; J. Adcock, builder, 21, Coleman Street, E.C. House, Ridgemount Estate; G. A. Franks, builder, Guildford.

ASHFORD.—Manual training workshop at the Grammar School. A. E. Lacey, architect, North Street, Ashford.

(TENTERDEN).—New Isolation Ward at the Workshop Infirmary, for the Tenterden Union. W. L. C. Turner, architect, Town Hall, Tenterden.

ASHINGTON.—Proposed new Council Chambers for the U.D.C.

BANGOR.—Museum buildings for the T.C. David Hughes & Owen, builders.

BANSTEAD (SURREY).—House, corner of Epsom Lane, for W. Cook; gymnasium, music and bed rooms, St. Monica's School, for Miss Helen Jones; houses, Epsom Lane and Tadworth Street, for W. H. Bartlett, Tredegar Works, Bow; additions to The Homestead, for W. W. Szlumper; house, Tadworth Street, for A. E. Ward; shops, Cross Road, Tadworth, for Cope and Furneaux; detached houses, Diceland Road, for T. S. Stoddart; additions to Station Hotel, Kingswood, for Watney, Combe, Reid & Co., Ltd., Stag Brewery, Pimlico.

BASINGSTOKE.—Additions to factory, Station Hill, for Gerrish, Ames and Simpkins.

BATLEY.—New church in place of St. Andrew's Mission Church (£7,000).

BEBINGTON (CHESHIRE).—New works to be proceeded with. Mersey Chemical Co.

BEDWORTH (near NUNEATON).—Houses, New Street, for W. Johnson, M.P.; Wootton Street, for T. Dewis; Newtown Road, for R. E. Richards; alterations and additions to premises, King Street, for Rev. W. Francis.

BELFAST.—Villas in St. James' Park, Falls Road; R. J. M'Connell & Co., architects, 37, Royal Avenue, Belfast. Contemplated hall for Labour Party, North Belfast. Branch office at Mountpottinger, for the Ulster Bank, Ltd.; Blackwood & Jury, architects, 41, Donegal Place, Belfast.

BERKSHIRE.—New elementary schools at Shinfield and Childrey. J. T. Morland, clerk to the Berkshire Education Authority, Reading.

BEXHILL.—Detached house, Sea Road, for W. Taylor; Pigott & Oxley, architects. Detached houses, Collington Avenue, for W. White; A. A. Oakden, architect. Detached house, Sutherland Avenue, for F. G. Miller; A. A. Oakden, architect. House, Collington Avenue, for Mrs. Barber; C. W. Spencer, architect. House in Sutherland Avenue for W. White; C. W. Spencer, architect. Addition to St. Barnabas Church; Dove Bros., architects and builders, Islington, N.

BIRMINGHAM.—New Fire Station for the T.C. Watch Committee; T. G. Price, architect, 63, Temple Row, Birmingham. Further extensions to the Solihull Workhouse; H. Taylor, chairman of the Workhouse Building Committee.

BLAIRGOWRIE (PERTHSHIRE). Extension of school. D. & J. R. McMillan, architects, Aberdeen.

BLYTH.—New Presbyterian Manse (£1,000).

BOLTON.—New offices to mills, Folds Road, A. Bromiley & Co.; dressing rooms, Manchester Road, Bolton Wanderers F.C.; timber stores in Back Latimer Street, Page & Son; additions to works in Chorley Street, Messrs. T. R. Bridson & Son. Extensions in contemplation for Messrs. Crooks, cotton spinners; Messrs. Barlow & Jones, spinners; and Messrs. Haslam, spinners.

BOSTON.—New schools (£8,800). G. E. Clarke, Town Surveyor, Municipal Buildings, Boston.

BRIDGEND.—Alterations and additions to the Angelton Asylum. R. S. Griffiths, architect, Tonypandy, Rhondda Valley.

BRORA (SUTHERLAND).—United Free Church and Manse for Deacon's Court of Clyne U.F. Church.

BUCKHAVEN (FIFE).—New Parish Council offices. Provost Ross, Buckhaven, Fife.

BUXTON.—Houses, Green Lane, for Mr. Vollmer.

CAMBORNE.—House, Tehidy Road, for F. Bottrall. F. Mills, architect, Wellington Road, Camborne.

CARLISLE.—Turkish Baths (£2,290). W. Johnstone, contractor, Carlisle.

CASTLEFORD (YORKS.).—Five houses, Nicholson Street. Garside & Pennington, architects, Pontefract.

CHATHAM.—Villa, Maidstone Road, for A. Burtenshaw; club room, Pagett Street, for Rev. C. J. La Touche; mission church, Walderslade, for Rev. C. J. La Touche.

CHESTER.—Proposed new Training College. County Education Committee, Chester.

CHILTON (FERRYHILL, Co. DURHAM).—Complete installation of thirty-one 32-c.p. lamps (electric light), for the T.C. M. Wright, clerk, 7, Dene Bridge, Ferryhill.

CHORLEY.—Houses, Barracks Road, Whittle-le-Woods, for Paul Haydock; Shawe's Farm, Anderton, for A. Bond.

CLOWN (near CHESTERFIELD).—Houses, Welbeck Street, Creswell, for A. F. Houfton; Barton Street, for the Clown Co-operative Society; King Street, Hodthorpe, for Mrs. Mottishaw; Mitchell Street, Clown, for H. Thompson; Elmton Road, Creswell, for Mr. Houfton.

COCKERMOUTH.—Houses, Winscales, for Martin Burns; Lowca Lane, for T. Birkett; farm buildings, Rye Hill, for Lord Lonsdale.

CONWAY.—Conversion of the old Post Office into Municipal Buildings. F. D. Cheers, architect, 19, Gainsborough Road, Sefton Park, Liverpool.

CRANBORNE (DORSET).—Alterations at 84, North Allington; A. E. Travers. Buildings at Spar Acre, for H. E. Hounsell, Ltd.

CROYDON.—Alterations and additions to Baptist Chapel, Whitehorse Road; E. Stones, architect, 1, Trump Street, E.C. Additions, St. James' Vicarage, Tavistock Road; Umlandt & Gibson, builders, 98, Cherry Orchard Road, Croydon. Alterations and additions, 70, Westow Hill; Macey & Sons, Ltd., builders, 24, Essex Street, Strand, W.C. Houses and shops, Selhurst Road; Dartnell and Banks, architects, 34, High Street, Croydon. Six houses, Whitehorse Road; F. H. Milton, 76, Haslemere Road, Croydon. Houses and shops, Brigstock Road; H. E. Davey, 20, Cassland Road, Croydon. Twelve houses, Richmond Road; W. M. Lucas, 91, Brigstock Road, Croydon. Four houses, Strathyre Avenue; W. G. Allen & Son, Tunstall Road, Croydon. Additions to Whitehorse Laundry, Whitehorse Road; W. Hards, 19, Selsdon Road, Croydon. Four houses, Lower Addiscombe Road; C. Carpenter, Lower Addiscombe Road, Croydon. Six houses, Barmouth Road; W. B. Coomber, 65, Pemdeyon Road, Croydon. Six houses, Melfort Road; C. Omerod, 5, Station Road, West Croydon.

DARLINGTON.—Houses, Elton Parade, for Hoskins & Brown; eighteen houses at Harrowgate Hill, for Mr. Martin.

DARTFORD.—Extensions to St. Alban's Road School (£1,677). W. F. Blay, builder, Dartford.

DORKING.—New administrative block at the hospital (£3,600). Local Isolation Hospital Committee.

DOUGLAS.—House, Cliff Estate, for R. J. Kelly.

DOVER.—Alteration to 11, Cannon Street. Bromley & Watkins, architects, Dover.

DUBLIN.—New R.C. schools for the Metropolitan Parish contemplated (£16,000).

DUDLEY.—Enlargement of Dudley Post Office. Postmaster, Post Office, Dudley.

DUNDEE.—Rifle range and saloon for St. Andrew's Parish Church Rifle Committee; secretary, St. Andrew's Church Rifle Club, Dundee. Alteration on property at 107 and 113, Overgate, for C. Mann; alteration to shop at 18, St. Andrew Street, for H. & F. Thomson; houses in Woodburne Street, for John Allan; and in Kinghorne Road, for Robert Burnett.

DUNFERMLINE.—Alterations at Downsville Crescent, for J. Wilson, Cameron Street; and alterations at Conston Street, for Mrs. Alston.

DUNSTABLE.—Prospective rebuilding, after fire, of the Wesleyan Chapel and Sunday Schools.

EAST COWES (I. of W.).—Houses, Whippingham Road, for Mr. Ransom; Grange Road, for Mr. Sibbick; Tower Road, for Mr. Poole.

EBBW VALE.—Ten villas. J. H. Walters, architect, Ebbw Vale.

EDINBURGH.—Two villas in Lismore Avenue; Fraser & M'Beath. Three tenements in Strathfillan Road; G. A. Wilson.

ELGIN.—New schools at Findochty. R. B. Pratt, architect, County Bank House, Elgin.

ENNISCORTHY (BALLINDAGGIN).—Sunday schools for the Very Rev. Canon Mechan. Plans, &c., at the Parochial House, Ballindaggin.

EPSOM.—House, Epsom Common, for C. Page; additions to Downside Cottage for Rev. E. W. Northey.

FARNBOROUGH (HANTS.).—Additions to residence, Farnborough Park, for Lieut. Hampshire.

FENCE HOUSES (Co. DURHAM).—Rebuilding "Three Horse Shoes Inn," Pit House Lane, Leamside, for the Newcastle Breweries Co., Ltd., Newcastle-on-Tyne.

FOLESHILL (near COVENTRY).—Houses, Grange Lane, for T. Randle; Bacon's Yard, for Mr. Walton; Bell Green, for Mr. Pearson, jun.

GLASGOW.—Three double villas in Southbrae Drive, Jordanhill, for W. Downs and Sons, Glasgow Road, Uddingston. Alterations to house, Monreith Road, East, Cathcart, for M'Whannell; Rogerson and Reid, 58, West Regent Street, Glasgow. Conversion of houses into shops, Alexandra Terrace, Cathcart, for Mackinnon and Browning. 123, Hope Street, Glasgow. Five tenements in Blawarthill Street, Yoker, for M. Urie & Sons, Laigtpark, Paisley. Double villa, Busby Road, Giffnock, for R. Watson, 231, Aikenhead Road, Glasgow. Villa, Calderwood and Montgomery Roads, for R. Hetherington, 19, St. Vincent Place, Glasgow. Double villa, in Penrith Avenue, Giffnock, for G. Dixon & Sons, Giffnock. Double villa, in Wykeham Road, Scotstounhill, for A. Gibson, 18, Barrington Drive, Glasgow.

GLASTONBURY.—Restoration of Glastonbury Abbey.

GLOSSOP.—New municipal offices under consideration.

GODSTONE (SURREY).—Rebuilding (after fire) of the King's Stores (licensed premises).

GREAT CROSBY (near LIVERPOOL).—Villa, Dowhills Road, for G. Howarth; 55 pairs of houses and six shops, Asquith Avenue, New Street, for G. R. Allison.

HAMPTON.—Six villas, Percy Road. Milestone & Collis, estate agents, High Street, Teddington.

HARDWICK.—Renovation of Hardwick Hall. Duke of Devonshire.

HEMEL HEMPSTEAD.—Additions and alterations, Lockers Park College, for P. Christopherson; additions to "The Poplars" for the Rev. Mother Superior; two houses for N. Micklem, M.P., Boxmoor, Herts.

HERTFORD.—Two houses, Pondcroft Road, Knebworth, for Mr. Darby; new Baptist Church, Burnham Green, Datchworth, for F. A. Lawrence.

HESSLE.—New building to replace Primitive Methodist Church, Southgate.

HEYWOOD.—Proposed Council school in Regent Street. H. C. Anderson, architect, 3, Longford Street, Heywood.

HITCHIN.—Proposed new Conservative Club.

HOUGHTON-LE-SPRING (Co. DURHAM).—Houses, Sunderland Street, for W. Young; Outram Street, for J. Hudson; Gilpin Street, for Ramsay & Frazer.

HYDE (CHESHIRE).—Houses, Fairbrother Street, for Mrs. A. Hall; Woodbrooke Avenue, for Ernest Pike; Gower Road, for Wm. Norgrove & Sons; additions to weaving shed, &c., for Gibraltar Mill Co., Ltd.; additions to Pole Bank Hall, Gee Cross, for T. C. Beeley.

ILFORD.—Houses, Clarissa Road, for P. G. Ashton; Felbrigge Road, for A. C. Corbett (E. T. Dunn, architect, 20, Mansfield Road, Ilford); Seven King's Road, for J. W. Warwick.

ILFRACOMBE.—Probable rebuilding, after fire, of Victoria House (boarding establishment), between Morthoe and Woolacombe, near Ilfracombe.

IRLAM (LANCS.).—House, Liverpool Road, for Sir Bosdin T. Leech; shop, Liverpool Road, for Joseph Royle.

KEARSLEY (near BOLTON).—Renovation of Uplands, Ringley, for the Rev. J. H. Street, Vicar of Ringley.

KETTERING.—House, Garfield Street, for T. Geary; stores, Trafalgar Road, for Mobbs & Lewis, Ltd., patent last makers; additions to factory, Canon Street, for A. Cooper; additions to County Court offices, West Street, for H. Lamb; shop and offices, Market Place, for L. B. Bagshaw.

KINGSTON-ON-THAMES.—Alterations and additions to buildings for Guardians. W. H. Hope, architect, 12, Clarence Street, Kingston-on-Thames.

LANGHOLM.—Alterations and additions to premises, Market Place, for J. B. Balfour.

LEEDS.—Wesleyan school at Headingley. G. F. Danby, architect, 73, Albion Street, Leeds.

(GUISELEY).—New Yeadon and Guiseley dual secondary school. W. Broadbent, architect, Leeds and Horsforth.

LEICESTER.—Extension of the Technical and Art Schools, The Newarke; Everard, Son & Pick, architects, 6, Millstone Lane, Leicester.

(KIBWORTH).—Extension to factory, for Johnson & Barnes; five houses, Fleckney Road, for Mr. Bolton.

LEVEN.—New hospital (£1,300). A. C. Dewar, architect, Leven.

LICHFIELD.—Houses, Grange Lane, for Messrs. Morecroft: St. Chad's Road, for J. R. Deacon; Ivanhoe Road, for W. Griffin.

LINCOLN.—Enlargements, &c. (£13,000). Lincoln Co-operative Society.

LIVERPOOL.—Four shops in Renshaw Street. Bullen Bros., Ltd., contractors, Liverpool.

LLANDUDNO.—Proposed new church on the West Shore.

LONDON, (S.E.).—Prospective rebuilding, after fire, of drying stores at Upper Globe Wharf, Rotherhithe Street, for the Dessicated Grain Co., Ltd.

(E.C.).—Buildings on site of 33, 34, 35, Gutter Lane and 6, Carey Lane. J. J. Jerram, builder, Crown Works, Boundary Road, East Ham.

(BROMLEY, E.).—Residence, Shawfield Park. W. J. Pamphilon, architect, 21, Finsbury Pavement, E.C.

(W.).—Alterations to 74, Brook Street. F. W. Foster, architect, 41, Bedford Row, W.C.; J. Kirkby, builder, 34, York Street, S.W.

(BARNES, S.W.).—Six houses. J. J. Fuller, builder, 14, Temple Road, Acton Green, W.

(W.).—Adaptation of 32, North Audley Street, for occupation by Edwin & Co., Court hairdressers and manicurists, 49, Park Street, Grosvenor Square, W.

(W.).—Hotel in Berners and Castle Streets. John Slater, architect, 46, Berners Street, W.; Holloway Bros., builders, Belvedere Road, Westminster Bridge.

(W.).—Conversion of 37, North Audley Street, into shop for L. Soloman, fruiterer, Covent Garden Market, W.C.

(WEST HAM, E.).—Adaptation of portions of schools for manual training: Wm. Jacques, architect, 2, Fen Court, Fenchurch Street, E.C. Day training college (250 places) proposed to be erected jointly by West Ham and Essex County Council Education Committees; secretaries, F. E. Hilleary, West Ham, and J. H. Nicholas, Chelmsford.

(CHISWICK, W.).—New Wesleyan Church in Sutton Court Road. Withers & Meredith, architects.

(ACTON, W.).—Villa residences at Cumberland Park. F. Barber, builder, Park Road North, Acton, W.

(FRIERN BARNET, N.).—Completion of St. John's Church (£2,500 already raised). Rev. E. J. Hall, rector.

(S.W.).—Alterations to No. 2, Carlton House Terrace (£2,050). Foxley & Co., builders, 26, Leinster Terrace, Bayswater, W.

(W.).—Additions to No. 45, Baker Street (£1,050). Foxley & Co., builders, 26, Leinster Terrace, Bayswater, W.

(W.).—Alterations to No. 7, Hyde Park Gate (£1,200). F. W. Foster, architect, 41, Bedford Row, W.C.

(S.W.).—Socialist headquarters at Fulham.

(N.).—New Wesleyan Methodist Sunday Schools at East Finchley.

(N.).—Baptist Church, corner of Pine Grove, Tollington Park.

(EDGWARE ROAD, W.).—Rebuilding Nos. 439 to 451 (£7,700). F. W. Foster, architect, 41, Bedford Row, W.C.; C. Gray, builder, Wellington House, S.W.

(MONTAGU PLACE, W.).—Additions and alterations to Nos. 12 and 13 (£1,600). F. W. Foster, architect, 41, Bedford Row, W.C.; J. Kirkby, builder, 34, York Street, S.W.

(HENDON, N.W.).—Phthisis ward in connection with Workhouse Infirmary. F. J. Seabrook, clerk to the Guardians.

(DEPTFORD, S.E.).—Additions to factory, Thurndley's Road. G. Parker, builder, 124, Sumner Road, Peckham, S.E.

(HAMPSTEAD ROAD, N.W.).—Buildings, near Euston Road. H. J. Williams, Ltd., builders, 11-17, Bermondsey Street, London Bridge, S.E.

(HOLBORN, W.C.).—Adaptation of premises in Staple Inn Buildings, for occupation as branch of Capital and Counties Bank, 39, Threadneedle Street, E.C.

(E.C.).—Prospective restoration (after fire) of warehouse, 83, Upper Thames Street.

LYTHAM.—Three detached houses, Myra Road, for Higham & Madden; detached houses, Norfolk Road, for H. Mogridge; St. Paul's Avenue, for A. S. Gledhill.

MAIDENHEAD.—Extensive alterations to business premises at 103, High Street, for F. Blumfield, house furnisher; houses, Braywick Road, for R. O. Pearce; Belmont Road, for S. G. Green; Forlease Road, for J. Wood; Alexandra Road, for E. Coxhead; boys' club, Cookham Road, for E. A. Myer; racquet court, Fernley, for L. R. F. Oldershaw.

MAIDSTONE.—New bank in High Street, for the London and County Bank, Ltd., London.

MANCHESTER.—New baths and washing house at Barnes Green (£88,000); Messrs. Normanton, contractors. New Y.M.C.A. buildings in Peter Street. Messrooms and shelters at Delamere Street Open Space and Plymouth Grove Recreation Ground, for the T.C.; City Architect, Town Hall, Manchester. New St. Anne's Parsonage, Edgeside, Waterfoot; A. Brocklehurst, architect, St. James' Chambers, Waterfoot, Manchester.

(URMSTON).—New Fire Station. District Council.

MANGOTSFIELD (BRISTOL).—Proposed new schools. J. W. Nicholls, Chairman of the Mangotsfield Parish Council.

MARAZION (CORNWALL).—Villa at the Picnic Grounds. J. A. Treglown, Auction and Valuation Offices, Marazion.

MARPLE.—Houses, Dorrfield, for T. Moss: Strines Road, for W. C. Jones.

MONMOUTHSHIRE.—Repairs at five schools for the Monmouthshire Education Committee. J. Bain, architect, High Street, Newport, Mon.

MORPETH.—Working-men's dwellings for the T.C. (£4,900).

MULLINGAR.—New operating ward for County Hospital.

NEATH.—Villa for F. Manton. J. Cook Rees, architect, Neath.

NEWBOTTLE (FENCE HOUSES, Co. DURHAM).—House and shop, for Messrs. Balmer; house, Gertrude Street, for Mr. Fisher; Bank Head, for J. Fisher.

NEWHILLS (ABERDEENSHIRE).—New science room at Bucksburn School. Kelly & Nicol, architects, 367, Union Street, Aberdeen.

NEWPORT (FIFE).—Shops at the corner of Newburgh and Hillpark Roads, for A. Stewart; alteration of houses on Tayport Road, for John Smeaton Fisher, 6, Whitehall Crescent, Dundee.

NEW ROMNEY.—Building for the Corporation. J. Bannon, Town Clerk, Town Hall, New Romney.

NEWTOWNSTEWART (Co. TYRONE).—New Presbyterian Church. Young and Mackenzie, architects, Scottish Provident Buildings, Belfast.

NORDEN (near ROCHDALE).—Houses, at Grimes, for J. S. Porter.

NORTHWICH.—New sewerage scheme (£7,000). Town Council.

OCKBROOK (near DERBY).—Important alterations and additions to Moravian School, including house for head-master, and chemical and physical laboratory (£2,000).

OLDHAM (CROMPTON).—House, at Shawside, for E. A. Leadbeater, mill manager.

OSWESTRY.—House, Welsh Walls, for Trevor Turner.

PARKSTONE (DORSET).—Conservative Club building at Newtown (£240). J. Wilson, contractor, Parkstone.

PENDLETON.—Alterations at Welsh Calvinistic Church in Broad Street. Trustees.

PAISLEY.—Additions to house, Blackland Mill, for A. Hamilton & Sons, Ltd., Paisley; additions to house, "Corsebar," for P. H. Coats, Corsebar, Paisley; two-storey building at Burnbank Chemical Works, Chain Road, for Wm. Forrest & Son, Paisley.

PENTRE (GLAM.).—Enlargement of the Boys' Department at the Council School. J. Rees, architect, Hillside Cottage, Pentre.

PERTH.—Double villa at Muirton Place. J. Monorieff, builder.

PLYMOUTH.—Dwelling houses; W. T. Jinkin, Endsleigh Yard, Plymouth. Reconstruction of buildings for the Co-operative Society. Secretary, Plymouth and District Co-operative and Industrial Society.

PONTARDULAIS (GLAM.).—New English Methodist Chapel. W. B. Rees, architect, Dumfries Place, Cardiff.

POOLE.—Club buildings, Ringwood Road, for A. G. Barralet; C. H. Goater, architect. Five houses on new road off Church Road East, for W. Andrew; four houses, Douglas Road, for T. J. Philpotts; two houses, Victoria Crescent, for A. Fripp; T. Heath, architect. Additions to Vallambrosa, Mount Pleasant Road, for Mrs. Fletcher; W. Buckley, architect. Pumping station at Corfe Mullen; Chas. Lisby, town clerk, Poole.

PORTMADOC.—Houses, Borthygest, for Richard Williams, 13, Glyn Terrace, Borthygest. O. M. Roberts & Son, architects, Portmadoc.

PORTSMOUTH.—Quarters for medical officers. Rake & Cogswell, architects, Prudential Buildings, Portsmouth.

PORT TALBOT.—New Congregational Chapel, for the Building Committee of the Tabernacle, Newydd. Evans & Jones, architects, 5, Station Road, Port Talbot.

RASTRICK (near BRIGHOUSE).—Proposed new church to replace St. John's.

RICHMOND (YORKS.).—Restoration of Richmond Castle.

RICHMOND-ON-THAMES.—Additions to 24, Kew Road. Worsfold & Hayward, architects, 80, Cannon Street, E.C.

ROCHESTER.—Houses, Mount Road, Borstal, for H. A. Saward; Cliffs Road, Strood, for the Trustees of the Wesleyan Church; Goddington Road, Strood Intra, for G. A. Martin.

ROMILEY (near STOCKPORT).—New premises for the Compstall Co-operative Society.

RYDE (I.W.).—Development of Seafield Estate, Sea View, for building purposes, Geo. Winch, owner; additions, including new dining hall, to the premises of the Y.M.C.A., Victoria Street.

ST. ANNES-ON-SEA.—Primitive Methodist Mission premises; Rev. G. Bichen, Liberal Assembly Room. Houses, Clifton Drive North, for W. Crawshaw, South Promenade, for S. Harwood; Queen's Road, for the executors of J. Whittle; Lightbourne Avenue, for Seth Harwood; extension of College, Clifton Drive South, for the Misses Oldfield.

ST. AUSTELL.—Four houses for Messrs. Sturbridge & Sons, Penwithick, St. Austell.

ST. HELENS.—Houses, Chancery Lane, for H. Callon; alterations and additions, Marshall's Cross, for Greenall, Whitley & Co., Ltd., brewers.

ST. STEPHENS (CORNWALL).—Three houses, for R. Tearle, St. Stephens. One house for the West of England China Stone Co., St. Austell.

SANQUHAR (DUMFRIESSHIRE).—Restoration of the Public Hall, for the Sanquhar Public Halls Co., Ltd. Ingram & Brown, architects, Kilmarnock.

SHERBORNE.—Two houses, St. Swithin's Road; E. W. Bartlett, builder, Sherborne.

SKIPTON.—Restoration of the Parish Church (£2,500). Austin & Paley, architects, Lancaster.

SKYE (N.B.).—Proposed McKinnon Memorial Hospital. Sir Donald Currie, Garth, Aberfeldy, N.B.

SLATEFORD (MIDLOTHIAN).—Proposed public hall for Slateford, Longstone and district. Councillor J. Cormack, Colinton, Midlothian.

SLOUGH.—New theatre (£15,000). Mr. Wilson, secretary of the Dramatic and Operatic Society, Slough, promoter.

STAMFORD.—House, Casterton Road, for John Hunt; four cottages on Lord Exeter's Estate, for E. F. Leaberry; new workshops, for Martin & Co., Ltd.

STANDISH (near WIGAN).—Extensions to the Standish Co.'s works, Worthington.

STIRLINGSHIRE.—Conversion of property into dwelling house and shop for T. Smith, Brightons.

STOCKPORT.—Alterations and additions to imbecile wards at the workhouse, for the B.G.; Pierce & Son, architects, St. Petersgate, Stockport. Business premises, North Reddish, for the Co-operative Society; Wrathmill & Blackshaw, architects, Queen's Buildings, St. Peter's Square, Stockport.

STOURBRIDGE.—New school (250 scholars). Worcester County Education Authority.

STROUD (GLOS.).—Rebuilding of Stratford Mills for R. Townsend & Co., oil cake manufacturers.

SUTTON-IN-ASHFIELD.—Houses, Kirkby Road, for A. Ellis; Station Road, for Mrs. Ashcroft; Reform Street, for J. Farrands; Morley Street, for W. Hayes.

SWADLINCOTE.—Houses, High Street, Newhall, for H. Clamp; alterations and additions to bank premises for Lloyd's Bank, Ltd., London.

SWINTON (near MANCHESTER).—Partial rebuilding, after fire, of engineering works. Messrs. Jos. Berry, Swinton Hall Road, Swinton.

TAYPORT (FIFE).—New hall in connection with Queen Street United Free Church.

THAMES DITTON.—School (£4,140). Jarvis & Richards, architects, 10, Queen Anne's Gate, Westminster; T. G. Hawkins & Co., builders, 109, Victoria Street, S.W.

TREFEGLWYS (MONTGOMERYSHIRE).—Alterations and improvements to the Council School, for the Montgomeryshire Educational Authority. L. Phillips, Clerk to the Educational Authority, County Educational Offices, Newtown.

TYWARDREATH (CORNWALL).—Four houses at Sandy Lane, Par Green, for J. T. Dunn, builder, Par Green, Tywardreath.

ULLAPOOL (ROSS-SHIRE).—New Free Church in Quay Street.

WALSGRAVE-ON-SOWE (near COVENTRY).—Houses, Lenton's Lane, for J. Barson.

WALTON-ON-THE-NAZE.—Motor garage for J. C. Moreland, cycle and motor engineer.

WARMINSTER (WILTS.).—House, Boreham Road, for Rev. H. L. Dixon; extension of the Chapel of St. Denys for Sir James Philipps.

WARWICK.—Additions to house, Mill Street, for Dr. Jameson; six houses, Linen Street, for Mr. Dunn; E.L. to be installed at the Court House, for the T.C.

WEMBLEY.—New church in East Lane. The Vicar, Wembley.

WEMYSS (FIFE).—New hospital (£4,000). Wemyss Estate Office.

WHITSTABLE.—Houses, Clare Road, for W. Camburn, builder, 53, Oxford Street; Northwood Road, for F. S. Gann.

WIDNES.—Houses, Fairfield Road, for E. Wood; Park Avenue, for F. Guy.

WILMSLOW (CHESHIRE).—Storerooms, &c. Surveyor, District Council, Wilmslow.

WORKSOP.—Houses, Hetherton Road, for Mr. McCarrick; Devonshire Street and Harrington Street, for C. Bacon; new public baths (£5,000).

WREXHAM.—New church house, &c. (£10,000). Protheroe, Philpott and Maynard, architects, Cheltenham.

YARDLEY.—Council Elementary School, in Golden Hillock Road, Greet. J. G. Dunn, architect, Cornwall Buildings, 45, Newhall Street, Birmingham.

YNYSDDU (MON.).—Proposed new school, at Cwmfelinfach, for the Monmouthshire Education Committee. R. L. Roberts, architect, Abercarn, Mon.

NOTES.

Municipal Tramway Employés. — According to a report issued by the Labour Department of the Board of Trade, the total number of workpeople in the employment of public authorities reported to have been affected by changes in rates of wages during 1907 was 8,640, the net result of the changes being an increase of £596 a week. The principal changes were an advance of 1s. a week to 1,364 drivers, conductors and car cleaners, and advances varying from 3d. to 3s. a week to 94 other employés in the tramway service at Glasgow; an advance of ½d. per hour to 609 employés in the tramway service at Sheffield; an advance of 1s. per week to 409 employés in the tramway service at Newcastle-on-Tyne; and advances of ½d. and ½d. per hour to 330 drivers and conductors at Glasgow.

Indian English.—The following application, forwarded to us by a reader in Calcutta, is printed precisely as written. While the candidate's scholarship is not profound, the fact that he has succeeded in clearly conveying his meaning in an alien tongue is distinctly to his credit. How many Englishmen can write as well, in any language but their mother tongue?—

To the Electrict Engineer.

Sir,—Hearing there is a vacancy as a Electriction and Mortor repairer, under your kind disposal, I respectfully beg to tender this my humble application for the same.

As regard to my ability and trade I beg to state that I served in various Firms, and holds certificates regarding my characters, which will no doubt will speak itself.

At present I am employed as a Mortor Repairer in B.O.C. Syriam, where as the place dosen't suits to my health.

If I be so fortunate to succeed the prayer applied for I shall try my utmost to give entire satisfaction in discharge of my duties to my supervisions.

For which act of kindness I shall every pray.

I beg to remain, Sir,
Your most obedient servant,
HAKAM SINGH, ELECTRICT
Burmah Oil Company P.O. Syriam,
RANGOON.

Electric Iron Practice.—The greater part of the efforts to apply the electric furnace to iron working has been in the direction of making special kinds of steel, where a somewhat higher cost of production does not render the operation prohibitive. In this direction rapid strides have been made, but the development of a furnace capable of smelting iron ores has been left very much in the back-ground. The experience gained from tests made in Canada, Sweden and Italy has shown that the smelting of iron ores by electricity is very expensive at the present price of electrical energy. It must be remembered, however, that the cost of fuel is constantly on the increase, and that our great water supplies are gradually being developed for the production of cheap electrical energy. It is probable, therefore, that the future will see the introduction of an electrical furnace capable of competing successfully with the time-honoured blast furnace. From this point of view the recent experiments of Clevenger and Lyon, in California, are of great interest. These metallurgists have constructed a 160-kilowatt, single-phase furnace for experimental work. This consists of a stack of concrete, 29 ft. high, with electrodes fixed in the walls of the crucible at the bottom. A variable voltage transformer is used to keep full power on the furnace at all times. The charging is done at the top, so that a long column of charge is effectually pre-heated before reaching the zone of fusion between the electrodes. These latter are 24 in. apart, and fit into the crucible, which is brick-lined and water-cooled. In this manner the lowest figure for a run was 0·35 KW.-year per ton of pig, but this includes the pre-heating of the furnace. These results are distinctly encouraging, and according to the *Journal of Electricity, Power and Gas*, form only the first stage of a series of more elaborate experiments. On these results a ton of pig could be produced for from 50s. to £3 with cheap power; making allowance for electricity at its present price a ton of pig would cost at least £4. Further than this, a 1,500-KW. furnace could produce only 15 tons of metal per day. On the other hand, such a furnace has many advantages over the blast furnace. It is cheap to construct and manage. It can be easily controlled, and a breakdown is a matter of no vital importance. The work, however, though not yet commercially successful, is advancing along the right lines, and those who wish to survive the competition of the future must keep in touch with the development of the electric smelting furnace.

Electrified Steam Railways in the U.S.A.—According to a paper before the American Society of Civil Engineers, the Denver and Interurban Railroad is the seventh large American steam railway to adopt electrical operation on its lines, the others being:—Baltimore and Ohio, 750-volt third-rail in Baltimore tunnel; New York, New Haven and Hartford, 600-volt trolley on certain branches, and 11,000-volt single-phase catenary trolley on the New York division and other branches; Long Island, 600-volt third rail on suburban lines, and 2,200-volt single-phase catenary trolley on interurban lines; Pennsylvania, 600-volt third rail on West Jersey and Seashore division; New York Central, 600-volt third rail on the main line, and 600-volt overhead trolley on West Shore division and on branches; Erie, 11,000-volt single-phase catenary trolley on Rochester division, and 600-volt D.C. trolley on branches. The Denver and Interurban Railway will be worked on the 11-000-volt single-phase trolley system.

From the same source it appears that the following steam roads are also installing electrical equipment:—Grand Trunk, 3,300-volt single-phase catenary trolley in Sarnia tunnel and approaches; Michigan Central, 650-volt third-rail in New Detroit tunnel; Great Northern, 6,600-volt three-phase trolley in Cascade tunnel; Southern Pacific, 1,200-volt D.C. trolley on Almeda Mole suburban lines in Oakland, Cal.; and Pennsylvania, electrification of New York terminal and tunnels.

The above do not include any interurban trolley lines, which were originally constructed as electric roads.

Valuations of Electrical Works for Assessment Reduced.—At the Arbroath Burgh Valuation Court, Mr. Adam Oliver, S.S.C., on behalf of the electric lighting company, appealed against the valuation of £1,200, and asked that it be entered for the first year at £180. Mr. Oliver stated that he had had considerable negotiations with the assessor in regard to the valuation, and without very much pressure the assessor came down to £450. He thought it was a fair thing to ask that this concern, which came at a time when the town was dull, and which he did not think had done any harm to the town, but, on the contrary, would do good, should be valued for the first year at a figure which would not have the effect of strangling a young concern. He referred to the valuation of other concerns of a similar kind throughout the country, and explained that the electricity works had only been running for a short time, and that, as a matter of fact, the works were not yet wholly completed. Mr. Hare, the Assessor, said that when he fixed the valuation at £1,200 he was without definite figures to go upon, and was then subject to adjustment. Since then he had learned of a decision in a recent Bo'ness case, and he now based his valuation so as to bring it into line with this particular case. Mr. Oliver held that the Bo'ness case did not apply to Arbroath. After consideration, Provost Alexander said the Court, taking into account the fact that the company were not yet fully equipped, that their works were not yet fully employed, and that they had only been in operation for a short period, had unanimously resolved to fix the valuation for this year at £225.

At Brechin, on Monday, the North of Scotland Electric Power and Light Co., Montrose, appealed against the Assessor's valuation of £660 on the local electric light station. Mr. Alex. Middleton, solicitor, Montrose, on behalf of the company, claimed that the present valuation of £200 should remain. He explained that the appeal was against two assessments, one for the station (£360) and one for the mains and cables (£300), or an increase of £460. The question between the company and the Assessor was as to whether the assessment should be calculated upon the revenue basis or upon the contractor's principle. The Assessor had calculated upon the contractor's basis, while he (Mr. Middleton) thought the proper basis to adopt was the revenue basis. The former method was one by which a certain percentage was taken upon the capital value, and the latter was a method by which an attempt was made to arrive at the rent which a tenant, as apart from the landlord, would give for the same premises. The company were the proprietors of three different stations, one in Montrose, where the capital value expended was £40,000 odd, and the assessed rental £220; one in Brechin, with £35,000 capital value and rental £200; and the third in Inverness, with £29,000 capital value and £255 yearly valuation.

The Assessor explained that in view of the decision against the Bo'ness Electric Power Co. in the Court of Session, he was entitled to adopt the contractor's principle in fixing the valuation. The capital cost of the local undertaking was £23,717 14s. 10d., not including the cost of the Provisional Order, £491 5s. 1d., which, reckoned in, made the total capital cost £24,208 19s. 2d., and which, at 3 per cent., gave the valuation at £726. He had, however, restricted it to £660 for this year, his reason being that when a new building was erected a certain amount of depreciation often took place. Provost Guthrie, who presided, remarked that the increase was tremendously high, and the Assessor stated that if the company came to a high position of prosperity and secured a reasonable valuation the revenue method would be adopted.

Mr. Middleton and the Assessor failed to come to a compromise, and the Court fixed the valuation at £400. On behalf of the company, notice of appeal was given.

An Automatic Fireman.—A correspondent sends us a newspaper account of a recent wedding at Hendon, according to which the bridegroom was "a mechanical stoker attached to H.M.S. *Perseus*," and "wore his picturesque naval uniform." This may afford central station engineers a new idea for carrying out extensions of plant, and perhaps gives a clue to the romantic names sometimes bestowed upon steam dynamos.

Gas Engine Standards.—In a communication to the American Society of Mechanical Engineers, Mr. J. R. Bibbins urges that gas-engine efficiency should be expressed in terms of effective heat value, but that the efficiency of the producer be stated as the ratio between the heat output of standard gas and the heat input of the fuel as fired. Regarding the definition of the indicated horse-power of a gas engine, which excited an acrimonious discussion in Germany some time ago, Mr. Bibbins endorses the practice of deducting all negative work, such as that expended in pumping externally to the combustion cylinder, on the ground that as the four-cycle engine does its own pumping in the cylinder, it would be unfair to compare its indicated horse-power with that obtained from the cylinder only of a two-cycle engine. Nevertheless, for the sake of clearness, he suggests that the I.H.P. so obtained should be designated the net or effective I.H.P., to distinguish it from the total I.H.P. in the case of a two-cycle or Diesel engine.

Appointment Vacant.—Jointer for Rangoon Electric Tramway and Supply Co., Ltd.

Manchester Cricket.—Under the title, "Manchester Corporation Electricity Works—Shut-down for Dickinson Street Station," we have received the following intelligence:—

On Saturday, the 12th inst., a very heavy load was expected, and the full power of both generating stations was brought into play. Unfortunately, this was found quite insufficient to prevent disaster, when the Dickinson Street power came into contact with that from Stuart Street, resulting in a complete shut-down for Dickinson Street. Perhaps the following will more fully explain:—The annual cricket match between teams representing Stuart Street and Dickinson Street Stations was played on the Openshaw ground on Saturday, the 12th inst. A very good game resulted in a victory for Stuart Street by 17 runs. The teams were as follows:—

Stuart Street: Messrs. A. E. McKenzie, H. C. Lamb, R. A. S. Duncan, G. H. Hubbard, H. Rigby, A. Wardle, A. L. Lunn, H. Collier, J. Tomlinson, B. P. Avis, T. Millward.

Dickinson Street: Messrs. F. H. Whysall, P. T. Fowler, J. Thomas, C. Beardshaw, J. H. Heneke, A. Hill, T. Law, J. Simpson, W. Deacon, J. Patton, M. Kelly.

For the winners, Mr. R. A. S. Duncan took three wickets for 10 runs and B. P. Avis five wickets for 14 runs.

Electricity for Deep Level Pumping.—In the course of the proceedings of the Cornwall Polytechnic Exhibition at Camborne there was a discussion by mining engineers and others on the subject of pumping machinery for deep levels.

Mr. W. A. Scott (Cardiff) put the electrical side of the question, observing that the quantities of water to be dealt with in Cornwall were nothing like those in South Wales. Therefore, it seemed to him that if Welsh coal-owners saw their way to adopt electrical power to the extent they had done, there was no particular reason why it should not be adopted in Cornwall. No doubt electrical machinery was as reliable as any mechanical appliances they could get. Mr. N. Trestrail (Redruth) argued vigorously in favour of the advantages of the Cornish engine and pump, the durability of

which, he said, was astounding. The electrical pumping man was telling them what he was going to do, but up to that point mining men were anxiously awaiting the result. Mr. Hards (Urban Electricity Supply Co., Camborne) also argued from the electrical standpoint, one of the points raised being overall efficiency. Mr. Scott interposed with figures, and Mr. Davey remarked, "I will give £100 to any charitable institution if you can bring proof of it." Mr. F. B. Jack (Worthington Co.) said as regarded efficiency of gears they were prepared to guarantee efficiency with gears alone of over 92½ per cent. This was done; there was nothing miraculous about it.

Educational Notes. — NORTHAMPTON POLYTECHNIC INSTITUTE.—The handbook of "Announcements" for the session 1908-9 has been issued, and gives particulars of the day and evening courses in engineering, mechanical and electrical, and other subjects in which the Institute specialises, such as technical optics, horology, &c. The day classes begin on October 5th, and the evening classes on September 28th. A new building is being erected to increase the available accommodation, and the Electrical Engineering Department announces that a full sessional course in wireless telegraphy and telephony will be given, the pioneer course held last May having proved very successful. Dr. R. M. Walmsley is the head of the Electrical Engineering Department, associated with Dr. C. V. Drysdale; Mr. H. M. Hobart lectures on electrical engineering design, Dr. J. Erskine-Murray on wireless telegraphy, and Mr. A. G. Ellis on dynamo design.

Electrical Trades Football League.—This league will hold its first concert and presentation of medals on November 7th, in the Large Hall at the Robertson Electric Lamp Works, Brook Green, Hammersmith.

Imperial College of Science and Technology.—On the afternoon of Wednesday, October 7th, in the Lecture Theatre of the Victoria and Albert Museum, South Kensington, Sir W. H. White, K.C.B., F.R.S., will preside, and will distribute the medals, prizes, &c., to students.

Pertinax Tubes.—A correspondent wants the maker's name.

Look Here on this Picture—then there on That!—We have received from Mr. A. H. Shaw, of Ilford, who is honorary secretary of the Associated Municpal Electrical Engineers (Greater London), a couple of posters which have been issued by the Association. These are the first of a series forming part of an educative publicity campaign, and they will be followed at intervals by various other posters dealing with special applications of electrical energy. The posters now before us—or is it really one poster in two halves?—are very large (60 in. × 40 in. each), highly coloured, and represent respectively the effects of gas and electrical illumination upon the housewife, the feline necessity, and the pet parrot. In the gas picture a headache, smelling salts, an irritated cat sniffing before the gas stove, a parrot that is "saying things" before it expires, are the expressed features. In the electrical there is neither headache nor smelling salts, the feline beast purrs beneath the electric stove, veritably wallowing in its radiant warmth, while the parrot on its perch looks down in mischievous merriment upon the transformation as its mistress, all smiles and dimples, pours out her tea, the water for which she has electrically heated. We hope that these posters, and the others that will follow, will be placed in positions prominent enough to catch the eye of the public, for they will arouse an interest if they may not immediately carry conviction. Mr. Shaw will be pleased to forward copies of the posters to parties outside the Association's own area, and he will be glad to answer any inquiries that may be put to him on the matter.

Rubber Exhibition.—On Monday last the first International Rubber Exhibition was opened at Olympia; it will remain open for a fortnight. In his address, the President, Sir H. A. Blake, stated that 30 countries had sent exhibits, and 18 Governments were officially represented. The planting of rubber trees in Ceylon, India and other Eastern countries during the last decade had extended over 400,000 acres. It is stated that the exhibits of rubber are worth a million sterling.

Copper.—Visible supplies of this metal still continue to rise in quantity. The figures in Messrs. Merton's circular for the end of August are 45,072 tons for this item, made up of 29,305 tons of standard copper in England, 1,966 tons of furnace material at Liverpool and Swansea, French stocks 5,476 tons of fine copper, and afloat from Chile and Australia 8,325 tons. The increase of 2,938 tons over the supplies visible at the end of July is principally made up of standard copper in English ports. Supplies from North America have fallen off slightly, Spain and Portugal considerably; but these fluctuate so much that an average over four months gives the figure as about normal. Australian shipments are well maintained. Deliveries, however, are down 2,500 tons, which may have something to do with the present hardening of the price.

M. Becquerel's Bequest to Science. — The *Times* correspondent at Paris reports that the late M. Henri Becquerel has left the sum of 100,000 fr. (£4,000) to the Academy of Sciences, in memory of his grandfather and father, who were, like himself, members of the Academy. The deceased *savant* leaves it to the Academy to use the interest either by creating an endowment or prize, or by distributing the income in a manner calculated to encourage the progress of science.

The Electrical Contractors' Association (Incorporated).—NORTHERN SECTION.—A meeting of this Section will be held at the Manchester Exhibition on Saturday, October 17th, at 11 a.m., to be followed by a propagandist meeting, open to all electrical contractors. The central board meeting is also to be held at the Exhibition on Friday, October 16th, at 11 a.m.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW *posted as to their movements.*

Central Station Officials.—At the meeting of the Worksop Urban Council, last week, Mr. Boswell moved to rescind a resolution passed in 1906 advancing the salary of MR. CROWTHER, engineer, to £200 per annum, to be further advanced by annual increments of £25 to a maximum of £300. He contended that the Council of 1906 ought not to bind its successors in increasing salaries. Mr. Thornton opposed rescission, and said that out of a list of 27 municipal undertakings with similar output, Worksop stood about equal to the best, and was better than the great majority. He claimed that this success was solely due to the energy and ability of the engineer. When Mr. Crowther got £300 he would not be having an excessive salary compared with the salaries of other engineers of similar works. The Council was morally bound to give Mr. Crowther the advance promised in 1906. On a vote being taken there were six for rescinding and eight against, two neutral; the arrangement for increasing the engineer's salary therefore continues.

The Eastbourne Electricity Committee has appointed MR. RANDALL GOODALL, of Plumstead, to the position of charge engineer at a salary of £2 per week. There were 105 applications for the post.

MR. W. F. LONG, city electrical engineer, left Cape Town for England on August 26th, per *Armadale Castle*, to arrange for the purchase of additional plant in connection with the extensions required at the Corporation Electric Light Works, owing to the agreement to supply energy in bulk to the Government and Harbour Board.

Tramway Officials. — MR. GEO. BENNETT, of the Bolton Corporation tramways staff, who is proceeding to Australia, has been presented by his colleagues with a solid leather travelling bag and a silver-mounted calabash pipe.

General.—MR. MEASHAM LEA, city surveyor and engineer at Truro for the past nine years, has been appointed municipal engineer at Karachi, India, with a commencing salary of £700, rising in four years to £1,000.

The *Times* states that MR. E. O. SACHS, chairman of the British Fire Prevention Committee, has been accorded the Russian Gold Medal for Merit on the Ribbon of St. Andrew for services rendered in the prevention of the outbreak of fires.

Indian Engineering says that MR. NOLAND NAYLOR recently went out from England for the Ceylon Government Railway to take charge of Stone's electric lighting system on the trains.

MR. A. C. ELLIS has resigned his position as general manager of the Metropolitan Railway Co. MR. ROBERT H. SELBIE, secretary, has been appointed to succeed him. MR. W. H. BROWN, the audit accountant of the company, now becomes secretary.

MR. ALEXANDER SPENCE, chief electrician at the Glasgow Iron and Steel Co.'s works, at Wishaw, while returning home on a motor-bicycle on Sunday night rode over a part of the road where metal had been newly laid, with the result that one of the tires of his machine burst and he was thrown violently to the ground. He sustained serious injury to the head.

We learn that MR. J. W. F. WARREN, of the firm of Warren, Beattie & Co., Ltd., electric power engineers, Middlesbrough, purposes going out to Smyrna this month in connection with the firm's business. He will leave about the 26th inst., and is open to receive communications from any readers who may desire him to transact any business on their behalf in Smyrna, Turkey and Egypt. We understand that Mr. Warren was for many years resident in Smyrna.

The *Times* states that MR. C. FENTON, assistant superintendent in the Central Telegraph Office, has been appointed Postmaster of Jersey.

MR. H. B. SHUTES, second assistant electrical engineer to the Bermondsey Borough Electricity and Destructor Department, having been appointed as manager to Messrs. Hales Clinkers, Ltd., New Southgate, London, N., was presented with a barometer by Mr. W. E. J. Heenan, borough electrical engineer, on behalf of the staff.

MR. P. G. PETTIFOR, of the British Ericsson Manufacturing Co., was on 16th inst. presented by the members of the staff with a marble clock upon the occasion of his marriage to Miss Gertrude West, daughter of Mr. T. J. West, Superintendent Engineer, North Midland Province, G.P.O.

NEW COMPANIES REGISTERED.

Victoria Garage and Electrical Co., Ltd. (99,389).—This company was registered on September 2nd, with a capital of £1,500 in £1 shares, to acquire the business carried on at St. John Street and Parkside, Coventry, as the Victoria Garage and Electrical Co., and the business carried on at 27, Fleet Street, Coventry, as the Stour Cycle and Motor Depôt. The subscribers (with one share each) are:—E. J. Swift, 6, Newcombe Road, Coventry, electrician; D. Thompson, 18, Rudge Road, Coventry, mechanic; A. Turner, 2, Waverley Road, Coventry, tobacconist. Private company. The first directors are E. J. Swift (managing director), D. Thompson and A. Turner. Registered office, 68, John Street, Coventry.

H. Hooper & Co., Ltd. (99,384).—This company was registered on September 2nd, with a capital of £5,000 in £1 shares (3,000 6 per cent. cumulative preference), to acquire the business of an electrical engineer and contractor carried on by H. Hooper at 181, High Street, Lewisham, as H. Hooper and Co. The subscribers (with one preference share each) are:—J. W. Vincent, 6, Holborn Viaduct, E.C., chartered accountant; J. B. Roberts, 49, Hurlingham Court, S.W., articled clerk. Private company. The number of directors is not to be less than two or more than five; the first are J. H. Bulkley and H. Hooper (permanent managing directors). Table "A" mainly applies. Registered office, 181, High Street, Lewisham.

Electrical and Engineering Supplies Co., Ltd. (99,423).—This company was registered on September 5th, with a capital of £1,000 in 950 preferred ordinary shares of £1 each, and 1,000 founders' shares of 1s each, to carry on the business of manufacturers of, and dealers in, electric light apparatus, conduits, dynamo machines, lamps, fittings and accessories, electric accumulators, motors, batteries, &c. The subscribers (with one share each) are:—J. A. Nones, 86, Upper Thames Street, E.C., merchant; W. D. Taylor, Havelock, St. James Road, Sutton, Surrey, electrical engineer; G. Wingfield, 9, Cargreen Road, South Norwood, S.E., retired chartered accountant. Private company. The number of directors is not to be less than two or more than five; the first are J. A. Nones and W. H. Taylor; qualification, £10.

Bastian Quartz Lamps, Ltd. (99,444).—This company was registered on September 8th, with a capital of £6,000 in 6,000 preference shares of £1 each, and 2,000 deferred shares of 1s. each, to acquire from C. O. Bastian certain British patents relating to vapour electric apparatus, to grant licences in respect thereof (and particularly a licence to the Brush Electrical Engineering Co., Ltd.), and to carry on the business of electricians, manufacturers of electrical lamps and apparatus, &c. The subscribers (with one deferred share each) are:—R. Rumney, 125, Strand, W.C., agent; F. Sidney, 2, Church Court, Clement's Lane, E.C., secretary; W. T. Hick, 2, Church Court, Clement's Lane, E.C., solicitor; D. Cameron, 1, The Gables, Hampstead Heath, N.W., secretary; C. A. Frith, 20, Clovelly Road, Hornsey, clerk; E. B. Rumney, 125, Strand, W.C., clerk; F. H. Trash, 125, Strand, W.C., salesman. Minimum cash subscription, 5 per cent. of any shares or debentures offered to the public. The number of directors is not to be less than two or more than six; the subscribers are to appoint the first; remuneration not more than £50 per annum for the chairman and not more than £25 each for the others (including managing director); registered by W. T. Hick, 2, Church Court, Clement's Lane, E.C.

State of Bahia South-Western Railway Co., Ltd. (99,497).—This company was registered on September 11th, with a capital of £200,000 in £1 shares, to adopt agreements (1) with B. B. de Oliveira and (2) with Fry, Myers & Co., to carry on the business of constructors and workers of railways, tramways, telegraph and telephone lines, &c., in Bahia or elsewhere in Brazil, to generate, accumulate, supply and use electricity for light, heat, power or other purposes, &c. The subscribers (each with one share) are:—W. Wallis, 205, Stanstead Road, Forest Hill, S.E., clerk; H. T. Jones, 48, Genesta Road, Westcliff-on-Sea, clerk; H. Colliner, 52, Harleyford Road, S.W., clerk; O. B. Jane, Munster Lodge, Leigham Court Road, Streatham, S.W., clerk; W. J. Yeoman, 111, East Dulwich Grove, S.E., clerk; S. H. Penwarden, 7, Comely Bank Road, Walthamstow, clerk; J. A. Fuller, 15, Rowton Avenue, Wood Green, N., clerk. Minimum cash subscription, 10 per cent. of the shares offered to the public. The number of directors is not to be less than three or more than seven; the subscribers are to appoint the first; qualification, £250; remuneration, £175 each per annum (£75 extra for the chairman) and 10 per cent. of the distributed profits, divisible.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Sloan Electrical Co., Ltd. (61,528).—This company's annual return, made up to July 22nd, has been filed. 5,000 "A" preference, four "B" preference, and 2,750 ordinary shares have been taken up out of a capital of £15,000 in 5,000 "A" preference, 5,000 "B" preference, and 5,000 ordinary shares of £1 each, £1,254 has been paid on four "B" preference, and 1,250 ordinary, and £6,500 is considered as paid on 5,000 "A" preference, and 1,500 ordinary. Mortgages and charges: Nil.

Berry Construction Co., Ltd. (91,165).—This company's annual return was filed on July 9th, when the entire capital of £10,000 in £1 shares had been taken up. £1 per share has been called up on 4,000, and £3,249 5s. has been received, leaving £750 15s. in arrears. 6,000 shares are considered as fully paid. Mortgages and charges: Nil. (Nominal capital since increased to £15,000 in £1 shares.)

Electric and General Investment Co., Ltd. (31,506).—This company's annual return was filed on August 18th, when the entire capital of £200,000 in 20,000 ordinary, 100 founders', and 19,000 preference shares of £5 each had been taken up. £1 per share has been called up on the ordinary and £5 per share on the founders' and preference shares, and £120,000 has been received. Mortgages and charges: £10,000.

Callender's Cable and Construction Co., Ltd. (48,915).—This company's annual return was filed on July 1st, when 85,000 ordinary, and 40,000 preference shares had been taken up out of a nominal capital of £500,000 in 60,000 ordinary, and 40,000 preference shares £5 each. £5 per share has been called up on 15,000 ordinary, and 40,000 preference, and £275,000 has been received. £100,000 is considered as paid on 20,000 ordinary. Mortgages and charges: £800,000.

St. James's and Pall Mall Electric Light Co., Ltd. (26,015).—A statement of the total amount outstanding on July 1st in respect of mortgages and charges created prior to that date and not required to be registered under Sec. 14 of the Companies' Act, 1900, has been filed pursuant to Sec. 12 of the Companies' Act, 1907. Particulars: 4½ per cent. debenture stock dated May 29th, 1900, securing £150,000.

J. G. White & Co., Ltd. (66,568).—This company's annual return was filed on July 24th, when the entire capital of £200,000 in 15,000 preference shares of £10 each, and 50,000 ordinary shares of £1 each had been taken up. £150,000 has been paid on the preference, and £50,000 is considered as paid on the ordinary. Mortgages and charges: Nil.

Keighley Electrical Engineering Co., Ltd. (44,893).—A statement of the total amount outstanding on July 1st in respect of mortgages and charges created prior to that date and not required to be registered under Sec. 14 of the Companies' Act, 1900, has been filed pursuant to Sec. 12 of the Companies' Act, 1907. Particulars: Mortgage dated September 21st, 1899, securing £3,000.

City of Carlisle Electric Tramways Co., Ltd. (62,601).—A statement of the total amount outstanding on July 1st in respect of mortgages and charges created prior to that date, and not required to be registered under Sec. 14 of the Companies' Act, 1900, has been filed pursuant to Sec. 12 of the Companies' Act, 1907. Particulars: Mortgage dated August 22nd, 1899, securing £40,000.

Reason Manufacturing Co., Ltd. (64,701).—A statement of the total amount outstanding on July 1st in respect of mortgages and charges created prior to that date, and not required to be registered under Sec. 14 of the Companies' Act, 1900, has been filed pursuant to Sec. 12 of the Companies' Act, 1907. Particulars: Indentures dated November 11th, 1882, and March 26th, 1906, securing together £3,200.

Llangollen and District Electric Light and Power Co., Ltd. (75,884).—This company's annual return was filed on July 2nd, when 2,114 shares had been taken up out of a nominal capital of £6,000 in 3,500 preference and 2,500 ordinary shares of £1 each. £1 per share has been called up on 2,114, resulting in the receipt of £2,110 5s.; £3 5s. remains in arrears. Mortgages and charges: £2,000.

City of Birmingham Tramways Co., Ltd. (49,548).—This company's annual return was filed on June 18th, when 60,000 ordinary and 40,000 preference shares had been taken up out of a nominal capital of £1,000,000 in 120,000 ordinary and 80,000 preference shares of £5 each. £5 per share has been called up on 6,047 ordinary, £1 per share on 53,953 ordinary, and £5 per share on 400,000 preference shares, resulting in the receipt of £284,191. £3 has been paid on three shares forfeited. Mortgages and charges: £300,000.

CITY NOTES.

Perth Gas Co., Ltd. (West Australia).

THE report of the directors for the half-year ending May 31st last shows that the net profit for that period was £13,799, which, with the balance brought forward, £8,347, makes a total of £22,146. The directors recommended that a dividend at the rate of 2s. per share be paid, absorbing £12,500, and leaving a balance to be carried forward of £9,646. The increased demand for electricity supply necessitated further extension of the generating plant, and, therefore, a duplicate of the last additions had been ordered from England, which would be in running order before next winter. Although the price of coal had considerably increased, the directors had every confidence that the continued extension of the business would enable the company to maintain its present position; the demand for gas for cooking purposes continued, and an increased revenue from this source was anticipated. The retiring directors, Messrs. W. Strickland and R. F. Sholl, offered themselves for re-election.

The accounts show a profit on the gas department of £4,359, and on the electric light department of £9,440. A sum of £5,000 has been added to the reserve fund, which amounts to £30,000, but is invested in plant. The price of energy has been reduced, the scale ranging from 6d. to 2½d. per unit. The results for the years 1906-7 and 1907-8 are as follows:—

Year.	Units sold.	Amount received.	Cost.	Profit.	Total cost per unit sold.
1908 ..	2,937,517	£42,764	£22,171	£20,592	2·356d.
1907 ..	1,920,917	£44,873	£21,124	£23,749	2·63d.

The Town Council has given notice of its intention to purchase the undertaking, but there is little probability of its doing so in the near future.

Direct West India Cable Co.—The directors' report for the year ended June 30th shows an available sum, after providing for debenture interest and including £30,047 brought forward, of £36,196. The directors recommend a further dividend of 3 per cent., making the usual distribution of 6 per cent. for the year and leaving £33,496 to be carried forward. During the year debentures have been paid off to the amount of £6,100, leaving £50,900 outstanding.

Anglo-Argentine Tramways Co., Ltd.—The directors have declared an interim dividend to June 30th last, of 5s. per share on the non-cumulative second preference shares, being at the rate of 10 per cent. per annum, less income-tax, payable on and after October 1st next. The transfer registers are closed from September 16th to 30th, both dates inclusive.

Halifax and Bermudas Cable Co.—For the year ended June 30th, the directors report that, after providing for debenture interest, and including £17,848 brought forward, there is an available balance of £20,943. They recommend a further dividend of 2½ per cent., making the distribution of 5 per cent. for the year as usual, and leaving £17,193 to carry forward.

Newcastle and District Electric Lighting Co., Ltd.—It is announced that the directors have decided not to pay an interim dividend for the half-year.

Bromley (Kent) Electric Light and Power Co., Ltd.—The directors announce a dividend at the rate of 4 per cent. per annum on the ordinary shares.

Thompson, Ritchie & Co., Ltd.—The authorised capital of this company has been increased to £15,000.

France.—The report of the Société Lyonnaise des Forces Motrices du Rhône, of Lyons, for the past financial year has just been issued. It shows a net profit of £96,320, as compared with £77,560 in the preceding 12 months.

MARKET QUOTATIONS.

Wednesday, September 16th.

CHEMICALS, &c.		Latest Price.	Fortnight's Inc. or Dec.
a Acid, Hydrochloric	per cwt.	5/-	..
a ,, Nitric	per cwt.	22/-	..
a ,, Oxalic	per cwt.	38/-	..
a ,, Sulphuric	per cwt.	5/6	..
a Ammoniac, Sal	per cwt.	42/-	..
a Ammonia, Muriate (crystal) ..	per ton	£38 10	..
a ,, ,, ...	per ton	£30	..
a Bleaching powder	per ton	£5 10	..
a Bisulphide of Carbon	per ton	£18	..
a Borax	per ton	£16	..
a Copper Sulphate	per ton	£21	..
a Lead, Nitrate	per ton	£27	..
a ,, White Sugar..	per ton	£24	..
a ,, Peroxide	per ton	£32	..
a Methylated Spirit	per gal.	2/6	..
a Potassium Bichromate, in casks	per lb.	8½d.	..
a Potash, Caustic (75/80 %) ..	per ton	£20	..
a ,, Chlorate	per lb.	3½d.	..
a ,, Perchlorate	per lb.	9d.	..
a Potassium Cyanide	per lb.	7d.	..
a Shellac	per cwt.	115/-	..
a Sulphate of Magnesia	per ton	£4 10	..
a Sulphur, Sublimed Flowers ..	per ton	£6 10	..
a ,, Recovered	per ton	£5 15	..
a ,, Lump	per ton	£5	..
a Soda, Caustic (white 70 %) ..	per ton	£10 15	..
a ,, Chlorate	per lb.	3½d.	..
a ,, Crystals	per ton	£3 5	..
a Sodium Bichromate, casks ..	per lb.	3d.	..
a ,, Cyanide (basis 100 %) ..	per lb.	7d.	..
METALS, &c.			
b Aluminium Ingots, in ton lots ..	per ton	£80	..
b ,, Wire, in ton lots ..	per ton	£180	..
b ,, Sheet, in ton lots ..	per ton	£128	..
c Babbitt's metal ingots	per ton	£50 to £130	..
c Brass (rolled metal 2" to 12") basis	per lb.	8d.	..
c ,, Tube (brazed)	per lb.	8¾d.	..
c ,, ,, (solid drawn).. ..	per lb.	7¾d.	..
c ,, Wire, basis	per lb.	6¾d.	..
c Copper Tubes (brazed)	per lb.	9¾d.	..
c ,, ,, (solid drawn) ..	per lb.	9¾d.	..
g Copper Bars (best selected) ..	per ton	£75	..
g Copper Sheet	per ton	£75	..
g ,, Rod	per ton	£75	..
c ,, (Electrolytic) Bars ..	per ton	£64	..
c ,, ,, Sheets ..	per ton	£80	..
c ,, ,, Rod ..	per ton	£69	..
c ,, ,, H.C. Wire	per lb.	8½d.	..
f Ebonite Rod	per lb.	3/8	..
f ,, Sheet	per lb	8/-	..
h German Silver Wire	per lb.	1/6	..
h Gutta-percha, fine	per lb.	5/6 to 6/6	..
h India-rubber, Para fine	per lb.	4/2	inc.
i Iron Pig (Cleveland warrants) ..	per ton	51/8½	inc.
l ,, Wire, galv. No. 8, P.O.qual.	per ton	£14	..
g Lead, English Ingot	per ton	£13 10	..
m Manganin Wire No. 28	per lb.	8/-	..
g Mercury	per bot.	£8 5	2/6 inc.
d Mica (in original cases) small ..	per lb.	6d. to 1/-	..
d ,, ,, ,, medium	per lb.	2/6 to 4/-	..
d ,, ,, ,, large ..	per lb.	4/6 to 8/6	..
p Phosphor Bronze, plain castings	per lb.	1/- to 1/1½	..
p ,, rolled bars & rods	per lb.	1/2 to 1/6	..
p ,, ,, strip & sheet	per lb.	1/2½ to 1/5	..
o Platinum	per oz.	85/- to 90/-	..
e Silicium Bronze Wire	per lb.	9½d.	..
r Steel, Magnet, in bars	per ton	£55	..
g Tin, Block (English)	per ton	£129 10 to £130 10	dec.
n ,, Wire, Nos. 1 to 16	per lb.	1/9	..
p White Anti-friction Metals—			
"White Ant" brand	per ton	£34 to £58	..
k Zinc, Sh's (Vieille Montagne bnd.)	per ton	£24 5	£1 5 inc.

Quotations supplied by:—

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d F. Wiggins & Sons.
e Frederick Smith & Co.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakspeare.
h Edward Till & Co.
i Bolling & Lowe.
k Morris Ashby, Ltd.
l Richard Johnson & Nephew, Ltd.
m W. T. Glover & Co., Ltd.
n P. Ormiston & Sons.
o Johnson, Matthey & Co., Ltd.
p The Phosphor Bronze Co., Ltd.
r W. F. Dennis & Co.

British Electromobile Co., Ltd.—According to the *Financial News*, the report states that trading during the period to March 31st last resulted in a loss of £2,411. "As they have a sufficient number of carriages now available for hire to meet the present demand, the directors have decided to close and sub-let the works. They have decided to waive all claims to their remuneration as directors up to March 31st, and also to offer to cancel 3,928 shares of their respective holdings in order to write off the loss on revenue account, the preliminary expenses (£329), and the loss on fixtures, plant and stock, mainly due to the closing of the works (£1,188), on condition that eight founders' shares of a nominal value of 1s. each be created, and that the board shall have the right of subscribing for such shares in proportion to the shares surrendered. The founders' shares are to be entitled to a sum equal to 25 per cent. of the future profits of the company distributed in dividends on the remaining 12,447 ordinary shares."

STOCKS AND SHARES.

Tuesday Afternoon.

Business in the Stock Exchange is curiously irregular. An hour's activity is succeeded by quietude for twice as long, and the volume of trade has fallen off considerably on the whole. Home Rails underwent a sudden change, in being strong after their long period of dulness, but for this movement a little professional buying had much more to do than any particular investment by the public. Consols continue flat, wet-blanketing high-grade securities.

Metropolitans and Districts are well to the front in the railway revival. The Consolidated stock of the former rose a point, and Districts went up 2 to 13½. Upon this, Underground Notes put on a point. The additional efforts being made to attract visitors to the Franco-British Exhibition appear to be well rewarded, and traffics are maintained steadily enough. Central Londons, however, have so far failed to participate in the better feeling in this department, both the Ordinary and Deferred stocks being a point lower. City and South London keeps about 32½.

Debenture stocks for other Tube railways are unaltered. Bakerloo Debenture is 93, Piccadilly 92 and Charing Cross 83½.

City of London Electric Preference are ¼ higher at 12½, which figure appears to represent their fair value under present conditions. Westminster Preference at 5¼ are ¼ lower, while the deduction of 2s. dividend from Chelsea shares was made the excuse for putting down the price ¼ to £3 middle. The Newcastle-on-Tyne and District Electric Lighting Company has passed the interim dividend on its Ordinary shares.

River Plate shares are still advancing, the Ordinary being 3s. 6d. better at 1¼. The Debenture stock is par, and the Preference shares stand at a sovereign.

With a rise of nearly 9 points, Mexican Light and Power Common stock advanced to 79, the Preference stock and the bonds remaining at 113 and 93½ respectively. Mexican Electric Light Company 5 per cent. First Mortgage gold bonds hardened to 89¾, and Canadian General Common shares are 2 up at 109, the Preference also being better at 116.

The Tramway issues of this group are mostly firm. Mexico Tramways Common stock at 125 and the 5 per cent. gold bonds at 93 are not materially altered. Rio shares eased off to 68, and Sao Paulo at 157 show a fall of 1 per cent. United Electric Tramways of Monte Video descriptions are receiving a little attention, more especially the 5 per cent. First Debenture stock, standing about 98. The Ordinary shares of this company are quoted at 5⅛, and 6 per cent. cumulative preference at 5½, both being of the nominal value of £5 each. Bahia Tramway Light and Power shares at about 21½ are rather fancied as a gamble.

Substantial rises in British Columbia Electric Railway stocks are a noticeable feature of the traction department. The Deferred gained 5 more points, the Preferred 4, and the Preference 1. Optimistic dividend estimates are afloat to account for the remarkable strength displayed during the last few weeks in these stocks.

British Westinghouse 4 per cent. Debenture is 2 points down at 43½, the 6 per cent. prior lien Debentures remaining about 68 for the £68-paid scrip. Crompton Debentures have shot up 6 to 97½. This was due to nothing more than a small demand in a market poorly supplied with stock. Other manufacturing shares are quiet. India-rubber companies' issues are rising in consequence of the Exhibition opened at Olympia last Monday. It may be hoped that there will be none of the reckless speculation in rubber shares which was the cause of the first boomlet being so badly upset.

Telegraphs are somewhat devoid of feature, though prices continue to be well maintained. The American group is particularly steady. Mackay shares of each class are 1 down, *ex* the same amount of dividend. Globe Ordinary and Preference hardened ¼ each. Gt. Northern Telegraphs are 10s. better, and Telegraph Constructions gained a similar sum. Telephone descriptions are irregular. The National Company's securities have not moved; the discussion as to the possibility of cheaper telephone rates has not affected them. United River Plate Telephones have advanced. Orientals are slightly easier and American Telegraph and Telephone Common shares shed a point of their recent rapid gains.

Germany.—The report of the Hamburger Electricitäts Gesellschaft, of Hamburg, for the last financial year shows a net profit of £100,557, as compared with £100,452 in the preceding 12 months. A dividend of 8 per cent. is being declared.

SHARE LIST OF ELECTRICAL COMPANIES.

TELEGRAPH AND TELEPHONE COMPANIES.

Present Issue.	NAME.	Stock or Share. *	Dividends for the last four years. 1904.	1905.	1906.	1907.	Closing Quotations Sept. 8th.	Closing Quotations Sept. 15th.	Business done week ended Sept. 15th, 1908. Highest	Lowest.	Rise + or Fall −	Present Yield per cent. £ s. d.
25,000	Amazon Telegraph Co.'s shares, Nos. 1 to 25,000	10	Nil	Nil	Nil	Nil	2 — 3	2 — 3	..	..	..	Nil.
143,800	Do. do. 5 % Debs., Nos. 1 to 1,950 Red.	100	Nil	5 %	5 %	5 %	90 — 93	90 — 93	..	..	..	5 7 6
$131,551,400	American Telephone & Telegraph, Cap. Stock ..	$100	7¼%	7½%	8 %	8 %	133 —137	132 —136	..	..	−1	5 17 10
58,000,000	Do. Collat. Trust, 4% Bonds, 1 to 28,000 and 53,001 to 78,000	$1000	4 %	4 %	4 %	4 %	92 — 94	92 — 94	..	..	..	4 5 1
598,180	Anglo-American Telegraph	Stock	2⅜%	3½%	3⅞%	3½%	58 — 61	58 — 61	60½	..	..	5 14 9
3,200,910	Do. do. do. 6 % Pref.	Stock	5½%	6 %	6 %	6 %	104 —105	104 —105	105	104¼	..	5 14 3
3,200,910	Do. do. do. Deferred	Stock	Nil	1½%	1¾%	1 %	17 — 17½	17 — 17½	17 7/16	17½	..	5 14 3
50,000	Anglo-Portuguese Tel., 5 % Mort. Deb. Stock Red.	100	..	5 %	5 %	5 %	101 —104	99 —102 xd	..	..	..	4 16 2
44,000	Chili Telephone, Nos. 1 to 44,000	5	8 %	8 %	8 %	8 %	8 — 8½	8 — 8½	..	..	..	4 14 1
2,888,376	Commercial Cable Stlng. 500 year 4 % Deb. Sk. Red.	Stock	4 %	4 %	4 %	4 %	88½— 91½	89 — 91	90	..	..	4 7 1
16,000	Cuba Telegraph	10	5 %	5 %	5 %	6 %	7½— 8½	7½— 8½	..	..	..	7 1 2
6,000	Do. 10 % Pref.	10	10 %	10 %	10 %	10 %	15½— 16½	15½— 16½	..	..	+ ½	5 19 5
12,981	Direct Spanish Telegraph, Ord.	5	4 %	4 %	4 %	4 %	3 — 3½	3 — 3½	..	..	..	6 8 1
6,000	Do. do. 10 % Cum. Pref. ..	5	10 %	10 %	10 %	10 %	8 — 9	8 — 9	..	..	..	5 11 1
80,000	Do. do. 4½ % Debs.	50	4½%	4½%	4½%	4½%	100 —103	100 —103	..	..	..	8 14 10
60,710‡	Direct United States Cable	20	3½%	4½%	4½%	4½%	13½—13⅝	12½— 13⅝	13 11/16	13⅝	+ ⅛	6 3 8
50,900‡	Direct W. India Cable, 4½ % Reg. Deb., 1 to 1,200, R.	100	4½%	4½%	4½%	4½%	100 —102	100 —102	..	..	..	4 8 3
4,000,000	Eastern Telegraph, Ord. Stock	Stock	7 %	7 %	7 %	7 %	135½—138½	135½—138½	136½	..	..	5 8 4
2,000,000	Do. 8½ % Pref. Stock	100	8½%	8½%	8½%	8½%	84½— 86½	84½— 86½	86	85	..	4 0 11
1,896,706	Do. 4 % Mort. Deb. Stock. Red. ..	Stock	4 %	4 %	4 %	4 %	103 —105	103 —105	104½	..	..	3 16 2
800,000	Eastern Extension, Australasia, and China Tele.	10	7 %	7 %	7 %	7 %	123— 124	123— 124	13	12¾	..	5 5 8
752,400	Do. 4 % Deb. Stock	Stock	4 %	4 %	4 %	4 %	101 —103	100½—102½	101½	..	..	3 17 8
269,700	East & S. Afric. Tel., 4 % Mt. Db., 1 to 8,000, red. 1909	100	4 %	4 %	4 %	4 %	99½—101½	99½—101½	..	..	..	3 18 10
200,000‡	Do. 4 % Reg. M. Debs. (Mauritius Sub.) 1 to 8,000	25	4 %	4 %	4 %	4 %	101 —103	101½—103½	..	..	+ ⅛	3 17 4
181,127	Globe Telegraph and Trust	10	5⅛%	5⅛%	5⅛%	5⅛%	10⅜— 11	10⅜— 11⅛	10 15/16	10 13/16	+ ⅛	5 5 8
181,127	Do. do. 6 % Pref.	10	6 %	6 %	6 %	6 %	13⅜— 14	13⅜— 14⅛	13 15/16	13⅞	+ ⅛	4 4 3
150,000	Great Northern Telegraph, of Copenhagen	10	24 %	24%	20 %	20 %	27½— 29½	28 — 30	29½	29⅛	+ ⅛	6 13 4
19,600‡	Halifax and Bermudas Cable, 4½ % 1st Mort. Debs., within Nos. 1 to 1,200, Red.	100	4½%	4½%	4½%	4½%	100 —102	100 —102	..	..	..	4 8 3
17,000	Indo-European Telegraph	25	18 %	18 %	18 %	18 %	56 — 59	56 — 59	..	..	..	6 7 1
$41,380,400	Mackay Companies Common	$100	1 %	2 %	3½%	4 %	69 — 73	68 — 72 xd	..	..	..	5 9 7
$50,000,000	Do. do. 4% Cum. Pref.	$100	4 %	4 %	4 %	4 %	69 — 73	68 — 72 xd	..	..	..	5 9 7
384,190	Marconi's Wireless Telegraph	1	Nil	Nil	Nil	Nil	⅜— ½	⅜— ½	..	..	..	Nil
72,680	Monte Video Telephone Co., Ltd. Ord.	1	4 %	5 %	6 %	6 %	1 — 1⅛	1 — 1⅛	20/9	..	..	5 6 8
86,492	Do. do. do. 5 % Pref. ..	1	5 %	5 %	5 %	5 %	1 — 1⅛	1 — 1⅛	..	..	..	5 8 1
2,225,000	National Telephone, Pref. Stock	100	6 %	6 %	6 %	6 %	108½—110½	108½—110½	109⅝	109½	..	5 8 7
5,725,000	Do. do. Def. Stock	100	5 %	5 %	5 %	6 %	118 —120	118 —120	118½	118	..	5 0 0
15,000	Do. do. 6 % Cum. 1st Pref.	10	6 %	6 %	6 %	6 %	10½— 11½	10½— 11½	..	..	..	5 4 4
15,000	Do. do. 6 % Cum. 2nd Pref.	10	6 %	6 %	5 %	5 %	10½— 11½	10½— 11½	..	..	..	4 6 11
250,000	Do. do. 5 % Non-cum. 3rd P., 1 to 250,000	5	5 %	5 %	5 %	5 %	5⅝— 5¾	5⅝— 5¾	5 1/16	5⅝	..	4 6 11
2,000,000	Do. do. 3½ % Deb. Stock Red. ..	Stock	3½%	3½%	3½%	3½%	98½—100½	98½—100½	99⅛	..	..	3 7 8
1,716,593	Do. do. 4 % Deb. Stock Red.	100	4 %	4 %	4 %	4 %	103 —105	102½—104½	103½	103½	— ⅛	3 16 11
179,313	Oriental Telep. and Elec. 1 to 171,504, fully paid ..	1	6¾%	7 %	7 %	8 %	1 3/32— 1 5/32	1 3/32— 1⅛	26/3	..	+ 1/32	5 16 4
50,000	Do. do. do. 6 % Cum. Pref. ..	1	6 %	6 %	6 %	6 %	1 1/16— 1 1/16	1 1/16— 1 1/16	..	..	..	4 11 5
99,100	Do. do. do. 4 % Red. Deb. Stock ..	100	..	4 %	4 %	4 %	89 — 92	89 — 92	..	..	..	4 7 0
99,400	Pacific & European Tel., 4 % Guar. Debs., 1 to 1,000	10	4 %	4 %	4 %	4 %	99 —102	99 —102	..	..	..	3 18 5
11,889‡	Reuter's	8	5 %	5 %	5 %	5 %	7½— 8½	7½— 8½	..	..	..	5 0 0
99,100	Telephone Co. of Egypt, 4½ % Deb. Red.	100	..	4½%	4½%	4½%	99 —102	99 —102	..	..	..	4 8 3
8,088	Submarine Cables Trust	Cert.	6 %	6 %	6 %	6 %	128 —131	129 —132	..	..	+1	4 10 11
100,000	United River Plate Telephone	5	8 %	8 %	8 %	8 %	6⅝— 7⅛	6⅞— 7⅛	6⅞	..	+ ⅛	5 14 3
40,000	Do. 5 % Cum. Pref., Nos. 1 to 40,000	5	5 %	5 %	5 %	5 %	4½— 4¾	4½— 4¾	..	..	+ ⅛	5 2 7
80,008	W. Coast of America, 1 to 80,000 & 53,001 to 53,008	2½	Nil	Nil	2½%	2½%	1 1/16— 1 1/16	1 1/16— 1 1/16	..	..	..	4 8 11
150,000	Do. 4 % Debs., 1 to 1,500 guar. by Bras. Sub. Tel.	100	4 %	4 %	4 %	4 %	99 —102	99 —102	..	..	..	3 18 5
207,930	Western Telegraph, Ltd., Nos. 1 to 207,930 ..	10	7 %	7 %	7 %	7 %	13⅜— 13⅞	13⅜— 13⅞	13⅜	13 7/16	..	5 0 11
800,000	Do. do. 4 % Deb. Stock Red. ..	100	4 %	4 %	4 %	4 %	101½—103½	101½—103½	101½	..	..	3 17 4
88,321	West India and Panama Telegraph	10	Nil	Nil	Nil	Nil	⅜— ½	⅜— ⅝	..	..	..	Nil
84,568	Do. do. 6 % Cum. 1st Pref.	10	6 %	5 %	8 %	6 %	8 — 8½	8 — 8½	8 1/16	..	..	7 1 2
4,669	Do. do. 6 % Cum. 2nd Pref.	10	Nil	Nil	Nil	£2 6	8¼— 9½	8½— 9½	..	..	..	2 9 0
80,000‡	Do. do. 5 % Debs., Nos. 1 to 1,800 ..	100	5 %	5 %	5 %	5 %	101 —103	101 —103	..	..	..	4 17 1

ELECTRICAL RAILWAY, MANUFACTURING AND INDUSTRIAL COMPANIES.

320,000	Anglo-Argentine Trams, 10 % Nom. Cum. 2nd Pref., 260,008 to 580,097	5	8 %	8 %	8 %	9 %	8½— 8⅝	8½— 8⅝	8½	..	..	5 0 8
260,007	Do. 6 % Cum. Prefs., 1 to 260,007 ..	5	5⅛%	5⅛%	5⅛%	5⅛%	6⅝— 6 7/16	6⅝— 6 7/16	6⅝	..	..	4 9 4
266,600	Do. Permanent, 6 % Deb. Stock, 1888	100	6 %	6 %	6 %	6 %	142 —147	142 —147	..	..	..	4 1 8
285,100	Auckland E. Trams, 5 % 1st Mort. Deb. Stock ..	100	5 %	5 %	5 %	5 %	103 —106	103 —106	104½	..	..	4 14 4
580,000	Babcock & Wilcox, 1 to 580,000	1	20 %	20 %	20 %	20 %	3½— 4	3½— 4	80/-	77/6	..	5 0 0
100,000	Do. do. 6 % Cum. Pref., 1 to 100,000 ..	1	6 %	6 %	6 %	6 %	1⅛— 1⅜	1⅛— 1⅜	..	..	..	3 13 10
40,000	British Aluminium, Ord., 1 to 40,000	5	7 %	7 %	7 %	7 %	2⅜— 2⅝	2⅜— 2⅝	..	..	..	12 3 6
40,000	Do. do. 7 % Cum. Pref.	5	7 %	7 %	7 %	7 %	3⅜— 4⅛	3⅜— 4⅛	..	..	..	8 9 8
20,000	Do. do. "A" 6 % Cum. Pref.	5	6 %	6 %	6 %	6 %	4⅛— 4⅜	4⅛— 4⅜	..	..	..	6 6 4
20,000	Do. do. 4 % Funding Certs.	5	4 %	4 %	4 %	4 %	3¼— 4⅛	3¼— 4⅛	..	..	..	4 14 1
238,200	Do. do. 5 % 1st Mort. Deb. Stock Red.	Stock	5 %	5 %	5 %	5 %	106 —110	106 —110	..	..	..	4 10 11
300,000	Do. do. 5½ % Loch Leven Debs. ..	100	..	..	5½%	5½%	97 —100	97 —100	..	..	..	5 10 0
400,000	British Columbia E. Rail Def. Ord. Stock	100	6 %	6 %	6 %	8 %	132 —136	137 —141	139½	136	+5	5 13 6
300,000	Do. 5 % Pref. Ord. Stock	100	5 %	5 %	5 %	5 %	112 —116	116 —120	116	..	+4	4 3 4
300,000	Do. 5 % Cum. Perp. Pref. Stock	100	5 %	5 %	5 %	5 %	104 —108	105 —109	107½	..	+1	4 11 9
233,000	Do. 4½ % 1st Mort. Debs., 1 to 6,250	40	4½%	4½%	4½%	4½%	101 —104	101 —104	..	..	..	4 6 7
220,000	Do. 4½ % Vancouver Power Debs., 1 to 2,200	100	4½%	4½%	4½%	4½%	100½—103½	100½—103½	..	..	..	4 7 0
133,301	British Electric Traction	10	6 %	3 %	Nil	Nil	1⅛— 1⅜	1⅛— 1⅜	22/6	..	..	Nil
161,497	Do. do. 6 % Cum. Pref.	10	6 %	6 %	6 %	3 %	3½— 4⅛	3½— 4⅛	81/3	77/6	..	7 1 2
1,473,658	Do. do. 5 % Perp. Deb. Stock ..	Stock	5 %	5 %	5 %	5 %	96 — 99	96⅛— 99½	99½	98¾	+ ½	5 0 6
528,986	Do. do. 4½ % 2nd Deb. Stock Red.	100	4½%	4½%	4½%	4½%	76 — 78	76 — 78	..	..	..	5 15 5
100,000	British Insulated and Helsby Cables	5	8 %	8 %	10 %	10 %	6¾— 7	6¾— 6⅞	..	..	— ⅛	7 8 2
100,000	Do. do. 6 % Cum. Pref.	5	6 %	6 %	6 %	6 %	6 — 6¼	6 — 6¼	6 1/16	6¼	..	4 19 4
500,000	Do. do. 4½ % 1st Mort. Deb. Red. ..	100	4½%	4½%	4½%	4½%	103 —106	103 —106	..	..	..	4 4 11
212,000	British Thomson-Houston 4½ % 1st Mort. Debs. ..	100	4½%	4½%	4½%	4½%	91 — 96 xd	91 — 96	..	..	..	4 13 9
400,000	British Westinghouse 6 % Pref., 1 to 200,000 and 275,001 to 475,000	5	Nil	Nil	Nil	Nil	⅛— ¼	5/16— 7/16	..	..	..	Nil
1,016,358	Do. do. 4 % Mort. Deb. Stock ..	100	4 %	4 %	4 %	4 %	43 — 46	41 — 46	..	..	−2	8 14 0
50,000	‡Browett, Lindley & Co., Ord.	1	Nil	Nil	Nil	Nil	7/16— ½	7/16— ½	..	..	..	Nil
50,000	‡ Do. do. 6 % Cum. Pref.	1	Nil	Nil	Nil	Nil	14/6 to 15/6	14/6 to 15/6	..	..	..	Nil
105,781	Brush Electrical Engineering, Ord., 1 to 105,781 ..	2	Nil	2½%	Nil	Nil	0— ⅛	0 — ⅛	..	..	..	Nil
150,000	Do. do. Non-cum. 6 % Pref.	2	6 %	6 %	Nil	Nil	⅛— ¼	⅛— ¼	..	..	..	Nil
125,000‡	Do. do. 4½ % Perp. Deb. Stock	Stock	4½%	4½%	4½%	4½%	68 — 73	68 — 73	..	..	..	6 3 3
125,000‡	Do. do. 4½ % Perp. 2nd Deb. Stock ..	Stock	4½%	4½%	4½%	4½%	50 — 54	50 — 54	..	..	..	8 6
187,610	Calcutta Trams, 1 to 187,610	5	8 %	8 %	8 %	6 %	5½— 6	5½— 6	..	..	..	5 0 0
80,000	Do. 5 % Cum. Pref., Nos. 1 to 29,880..	5	..	5 %	5 %	5 %	4½— 5½	4½— 5½	..	..	..	4 15 3
850,000	Do. 4½ % 1st Deb. Stock..	100	4½%	4½%	4½%	4½%	101 —104	101 —104	104	102½	..	4 6 7
35,000	Callender's Cable Construction shares	5	12½%	15 %	15 %	15 %	9⅞— 10⅜	9⅞— 10⅜	..	..	..	6 19 6
40,000	Do. do. 5 % Cum. Pref.	5	5 %	5 %	5 %	5 %	5⅛— 5⅜	5⅛— 5⅜	..	..	..	5 6 11
800,000	Do. do. 4½ % 1st Mort. Deb. Stock Red.	Stock	4½%	4½%	4½%	4½%	107½—109½	107½—109½	..	..	..	4 2 2
491,222	Cape E Trams., 1 to 491,222	1	5 %	Nil	Nil	Nil	⅛— ¼	⅛— ¼	..	..	..	Nil
450,000	Castner-Kellner Alkali, 1 to 450,000	1	4 %	6 %	8 %	12 %	1⅛— 1⅛	1⅛— 1⅛	32/6	32/-	..	7 14 10
215,045	Do. do. 4½ % 1st Mort. Deb. Stock	100	4½%	4½%	4½%	4½%	105 —107	103 —107	..	..	..	4 4 1
1,893,610	Central London Railway, Ord. Stock	Stock	4 %	4 %	4 %	3 %	68 — 70	67 — 69	68⅜	67	−1	4 6 11
553,195	Do. do. 4 % Pref. Stock	Stock	4 %	4 %	4 %	4 %	84 — 86	84 — 86	86	..	..	4 13 0
553,195	Do. do. Def. do.	Stock	4 %	4 %	4 %	2 %	49 — 52	48 — 51	50	48	−1	3 18 5
1,480,000	City and South London Railway	Stock	2½%	17/8%	2½%	2½%	32 — 33	32 — 33	32 15/16	32	..	6 8 9

* Unless otherwise stated, all shares are fully paid. † A period of nine months. ‡ From Manchester Share List.

Continued on next page.

SHARE LIST OF ELECTRICAL COMPANIES.—(*Continued.*)

ELECTRICAL RAILWAY, MANUFACTURING AND INDUSTRIAL COMPANIES.—(*Continued*)

Present Issue.	NAME.	Stock or Share.	Dividends for the last four years. 1904.	1905.	1906.	1907.	Closing Quotations Sept. 8th.	Closing Quotations Sept. 15th.	Business done week ended Sept. 15th, 1908. Highest	Lowest.	Rise + or Fall —	esent Yield per cent. £ s. d.
85,000	Crompton & Co., Nos. 1 to 85,000	*	2½%	2½%	5 %	5 %	1 5/16 — 1 7/16	1 5/16 — 1 3/8	..	..	..	9 10 6
100,000‡	Do. 5 % 1st Mort. Reg. Debs., 1 to 900 of £100, and 901 to 11,000 of £50 Red.	..	5 %	5 %	5 %	5 %	90 — 98	96 — 99	..	..	+9	5 1 0
260,000	Dick, Kerr & Co., 1 to 260,000	1	10 %	10 %	10 %	10 %	1 1/2 — 1 3/4	1 1/2 — 1 3/4	..	..	..	6 13 4
305,000	Do. do. 6 % Cum. Pref., 1 to 305,000	1	6 %	6 %	6 %	6 %	1 5/16 — 1 7/16	1 5/16 — 1 7/16	..	..	..	4 11 5
282,580	Do. do. 4½ % Deb. Stock	100	4½%	4½%	4½%	4½%	100 —103	100 —103	..	..	..	4 7 5
60,000	Dublin United Trams. (1896), 1 to 60,000	10	6 %	6%	6 %	6%	11½ — 12½	11½ — 12½	..	..	..	5 4 0
59,987	Do. 6 % Pref. between 1 and 60,000	10	6 %	6 %	6 %	6 %	12½ — 13½	12½ — 13½	..	..	..	4 8 11
99,261	Edison & Swan Utd., "A" shs., £3 pd., 1 to 99,261	5	2½%	4½%	4½%	4½%	3 — 3 1/8	3 — 3 1/8	..	..	..	16 12 6
17,189	Do. "A" shares, 01—017,189	5	2½%	4½%	4½%	4½%	2½ — 2¾	2½ — 2¾	..	..	..	8 6 9
319,475	Do. 4 % Deb. Stock Red.	100	4 %	4 %	4 %	4 %	76 — 79	76 — 79	..	..	..	5 1 3
72,220	Do. 5 % 2nd Deb. Stock Prov. Certs. all pd.	100	5 %	5 %	5 %	5 %	85 — 87	85 — 87	..	..	..	5 14 11
112,100	Electric Construction, 1 to 112,100	2	4 %	Nil	Nil	Nil	3/8 — 7/16	3/8 — 7/16	14/9	14/-	..	Nil
31,890	Do. do. 7 % Cum. Pref., 1 to 31,890	2	7 %	7 %	7 %	7 %	1½ — 1¾	1½ — 1¾	..	..	..	Nil
25,000	General Electric Co. (1900), 5 % Cum. Pref.	10	5 %	5 %	5 %	5 %	7½ — 8	7½ — 8	..	..	..	6 5 0
200,000	Do. do 4 % Mort Deb.	Stock	4 %	4 %	4 %	4 %	86 — 90	86 — 90	..	..	..	4 8 11
78,000	Gt. N. & City Rail. Pref. Ord. "A" 4 %, 1 to 78,000	10	4 %	4 %	4 %	4 %	¾ — 1	¾ — 1	..	..	..	5 0 0
96,000	Greenwood & Batley, 7 % Cum. Pref.	10	7 %	7 %	7 %	7 %	10½ — 10¾	10½ — 10¾	..	..	..	6 10 8
80,000	Do. do. 5 % Mort. Debs.	100	5 %	5 %	5 %	5 %	102 —108	102 —108	..	..	..	4 17 1
40,000	Henley's (W. T.), Telegraph Works, Ord.	5	15 %	15%	15 %	15%	10½ — 11½	10½ — 11½	..	..	..	8 13 10
40,000	Do. do. 4½ % Pref.	5	4½%	4½%	4½%	4½%	5 — 5½	5 — 5½	..	..	..	4 1 10
150,000	Do. do. 4½ % Mort. Deb. Stock	Stock	4½%	4½%	4½%	4½%	107 — 109	107 — 109	..	..	..	4 2 7
50,000	India-Rubber, Gutta-percha & Telegraph Works.	10	5 %	10%	10 %	10 %	15½ — 16½	15½ — 16½	..	..	..	6 1 8
37,500	†Liverpool Overhead Railway, Ord.	10	1½%	Nil	Nil	½%	1⅜ — 1½	1⅜ — 1½	..	..	..	4 0 0
10,000	† Do. do. Pref., fully paid	10	5 %	5 %	5 %	5 %	5½ — 6	5¼ — 6	..	..	..	8 6 8
600,070	London United Trams. (1901), 1 to 50,007	10	6 %	3 %	3 %	3 %	6¼ — 6⅝	6¼ — 6⅝	..	..	..	4 8 11
399,980	Do. do. 50,008 to 100,000	10	6 %	3 %	3 %	3 %	6¼ — 6⅝	6¼ — 6⅝	..	..	..	4 8 11
125,000	Do. do. 5 % Cum. Pref., 1 to 125,000	10	5 %	5 %	5 %	5 %	5⅝ — 6⅛	5⅝ — 6⅛	..	..	..	7 13 10
1,881,000	Do. do. 4 % 1st Mort. Deb. Stock	100	4 %	4 %	4 %	4 %	75 — 80	75 — 80	76	..	..	5 0 0
5,782,062	Metropolitan Consolidated	100	3 %	2⅜%	1 %	1%	35 — 36	36 — 37	37¼	35¼	+1	1 7 0
2,640,914	Do. Surplus Lands	100	2⅜%	2⅜%	2⅜%	2⅜%	65 — 67	64 — 68	67	65½	+1	4 0 11
3,285,000	Do. District	100	Nil	Nil	Nil	Nil	11 — 12	13 — 14	13¾	11 3/16	+2	Nil
314,016	Metropolitan Electric Trams., Defd.	1	Nil	Nil	Nil	Nil	1/16 — 1/8	1/16 — 1/8	..	..	..	Nil
500,000	Do. do. 5 % Cum. Pref.	1	5 %	5 %	5 %	5 %	1/8 — 3/16	1/16 — 1/8	15/6	..	..	6 13 4
850,000	Do. do. 4½ % Deb. Stock Red.	100	4½%	4½%	4½%	4½%	92 — 95	92 — 95	..	..	..	4 14 9
245,500	Potteries E. Tre.	1	5 %	4 %	4 %	4 %	1/16 — 1/8	1/16 — 1/8	..	..	..	8 0 0
245,500	Do. 5 % Cum. Pref.	1	5 %	5 %	5 %	5 %	1/16 — 3/32	1/16 — 3/32	..	..	..	6 17 11
245,000	Do. 4½ % Deb. Stock	100	4½%	4½%	4½%	4½%	93 — 96	93 — 96	..	..	..	4 18 9
87,350	Telegraph Construction and Maintenance	12	15 %	15 %	15 %	17½%	32 — 34	32½ — 34½	34	32½	+½	6 18 8
150,000‡	Do. 4 % Deb. Bds., 1 to 1,500 Red., 1909	100	4 %	4 %	4 %	4 %	100½ —102½	101 —103	..	..	+½	3 17 8
3,599,200	Undergd. E. R., Lon., 5 % Profit Shar. S. Nts.	..	5 %	5 %	5 %	5 %	38 — 42	39 — 43	..	..	+1	11 12 6
66,666	Willans & Robinson, 1 to 30,000 & 80,001 to 116,666	1	Nil	Nil	Nil	10 %	1/8 — 1/4	1/8 — 1/4	..	..	..	8 0 0
66,666	Do. 6 % C.P., 30,001 to 80,000 & 125,001 to 141,666	5	Nil	Nil	..	6 %	2½ — 3	2½ — 3	55/-	54/4½	..	10 0 0
46,404	Do. 4 % 1st Mort. Deb. Stock	100	4 %	4 %	4 %	4 %	72 — 76	72 — 76	72½	72	..	5 5 3

ELECTRICITY SUPPLY COMPANIES.

15,000	Bromley (Kent) E.L. & P., 1 to 15,000	5	5½%	5½%	5½%	5½%	4½ — 5	4½ — 5	..	..	..	5 10 0
70,000	Do. do. 4½ % 1st. deb. stock	100	4½%	4½%	4½%	4½%	94 — 97	94 — 97	..	..	..	4 12 9
30,131	Brompton & Kens. Elec. Lt. Sup., Ord., 1 to 20,000	5	10 %	10 %	10%	10 %	6⅞ — 7⅛	6⅞ — 7⅛	..	..	..	6 9 0
9,869	Do. do. 7 % Cum. Pref.	5	7 %	7 %	7 %	7 %	6⅞ — 7⅛	6⅞ — 7⅛	..	..	..	4 13 4
336,876	Central Electric Supply 4 % Guar. Deb. Stock	100	4 %	4 %	4 %	4 %	99 —102	99 — 102	..	..	..	3 18 5
80,000	Charing Cross and Strand Electricity Supply	5	8 %	5 %	5 %	5 %	3¾ — 4	3¾ — 4	..	..	..	6 5 0
80,000	Do. do. do. 4½ % Cum. Pref.	5	4½%	4½%	4½%	4½%	4 — 4¼	4 — 4¼	85/-	..	..	5 0 0
80,000	Do. "City Undertaking" 4½ % Cum. Pref.	5	4½%	4½%	4½%	4½%	3¾ — 4	3¾ — 4	..	..	..	5 12 6
445,736	Do. do. 4 % Deb. Stock Red.	100	4 %	4 %	4 %	4 %	96 — 99	94½ — 96½	..	..	..	4 0 10
49,436	Chelsea Electricity Supply, Ord.	5	6 %	6 %	4½%	4½%	3 — 3½	2⅞ — 3¼ xd	..	..	..	6 8 7
175,000‡	Do. do. 4½ % Deb. Stock Red.	Stock	4½%	4½%	4½%	4½%	100 —103	100 —103	..	..	..	4 7 5
70,595	City of London Elec. Lighting, Ord. 40,001—110,595	10	6 %	6 %	6 %	6 %	9½ — 10¼	9⅝ — 10¼	9 11/16	9 5/8	..	5 17 1
40,000	Do. 6 % Cum. Pref., 1 to 40,000	10	6 %	6 %	6 %	6 %	11½ — 12½	12 — 13	..	..	+ ½	4 12 4
400,000‡	Do. 5 % Db. Stk., Scrip. (iss. at 115) all pd.	..	5 %	5 %	5 %	5 %	122 —125	122 —125	..	..	..	4 0 0
800,000	Do. 4½ % 2nd. Db. Stk., Prov. Crts., all pd.	100	4½%	4½%	4½%	4½%	101 —104	101 —104	..	..	..	4 6 7
40,000	County of Durham Electrical Power, Ord.	5	£3 7 0	4 %	4 %	2 %	2½ — 3	2⅝ — 3	..	..	..	3 6 8
50,000	Do. do. do. 5 % Pref.	5	5 %	5 %	5 %	5 %	3½ — 4¼	3½ — 4¼	..	..	..	5 17 8
40,000	County of London Electric Lighting, Ord. 1—40,000	10	4½%	5 %	5 %	5 %	7½ — 8½	7½ — 8½	7⅞	..	..	5 17 8
40,000	Do. do. 6 % Pref., 40,001—60,000	10	6 %	6 %	6 %	6 %	10⅜ — 10¾	10⅜ — 10¾	10 3/4	10 3/16	..	5 10 4
400,000‡	Do. do. 4½ % Deb. Stock	..	4½%	4½%	4½%	4½%	107 —110	107 —110	..	..	..	4 1 10
400,000	Do. do. 4½ % 2nd. Deb. Stock	Stock	4½%	4½%	4½%	4½%	99 —102	99 —102	..	..	..	4 8 3
80,000	Edmundson's Electric Corporation, Ord. Shares	5	7 %	4 %	Nil	Nil	1/16 — 3/32	1/16 — 3/32	..	..	..	Nil
80,000	Do. do. 6 % Cum. Pref.	5	6 %	6 %	3 %	Nil	3/4 — 1	3/4 — 1	14/9	..	..	Nil
438,000	Do. do. 4½ % 1st Mort. Deb. Stk.	100	4½%	4½%	4½%	4½%	59 — 66	59 — 66	..	..	..	6 16 4
10,000	Folkestone, 1 to 10,000	5	5½%	5½%	5½%	5½%	4¾ — 5¼	4¾ — 5¼	..	..	..	5 4 9
10,000	Do. 5 % Cum. Pref., 1 to 10,000	5	..	5 %	5 %	5 %	5 — 5¼	5 — 5¼	..	..	..	4 10 0
90,000	Do. 4½ % 1st Deb. Stock	100	4½%	4½%	4½%	4½%	97 — 100	97 —100	..	..	..	4 10 11
15,000	Hove, 1 to 18,000	5	8½%	9 %	9 %	8½%	6 — 6½	6 — 6½	..	..	..	6 10 9
21,000	Kensington and Knightsbridge Electric Ord.	5	12 %	10 %	10 %	10 %	7¾ — 8¼	7¾ — 8¼	..	..	..	5 14 3
90,000	Do. do. do. 4 % Deben. Stk.	Stock	4 %	4 %	4 %	4 %	94 — 97	94 — 97	..	..	..	4 2 6
10,000	London Electric Supply Corporation, Limited, Ord.	3	3 %	4 %	4 %	2½%	¾ — 1⅛	¾ — 1⅛	..	..	..	5 8 1
70,000	Do. do. do 6 % Pref.	5	6 %	6 %	6 %	4½%	4⅜ — 4¾	4⅜ — 4¾	..	..	..	6 3 1
74,395	Do. do. 4 % 1st Mort. Deb. Stk. Red.	Stock	4 %	4 %	4½%	4½%	89 — 92	89 — 92	..	..	..	4 17 10
200,000	Metropolitan Electric Supply, 1 to 100,000	5	10 %	10 %	8 %	6½%	4¼ — 4⅜	4¼ — 4⅜	90/-	87/6	..	6 16 10
76,121	Do. 4½ % Cum. Pref. 1—71,106	5	4½%	4½%	4½%	4½%	4⅜ — 5	4⅜ — 5	..	..	..	4 12 4
220,000‡	Do. 4½ % 1st Mort. Deben. Stock	..	4½%	4½%	4½%	4½%	105 —109	105 —109	..	..	..	4 2 7
250,000‡	Do. 3½ % Mort. Deben. Stock Redem.	Stock	3½%	3½%	3½%	3½%	84 — 89	84 — 89	..	..	..	3 18 8
250,000	Midland Electric Corporation, 4½ % 1st Mort. Deb.	100	4½%	4½%	4½%	4½%	94 — 97	94 — 97	..	..	..	4 12 9
87,500	Newcastle-on-Tyne, 1 to 87,500	5	8 %	8 %	8 %	8 %	5⅝ — 5⅞	5⅝ — 5⅞	..	..	..	7 2 3
87,500	Do. 5 % Pref., 1 to 87,500	5	5 %	5 %	5 %	5 %	5⅜ — 5⅝	5⅜ — 5⅝	..	..	..	4 6 11
10,852	Notting Hill Electric Lighting	10	7 %	7½%	7½%	7½%	11⅞ — 12⅜	11⅞ — 12⅜	..	..	..	5 17 8
20,000	Oxford, 1 to 96 and 407 to 20,310	5	7 %	7 %	7 %	7 %	5⅝ — 6⅛	5⅝ — 6⅛	..	..	..	5 14 3
50,000	Do. 4 % Deb. Stock	100	4 %	4 %	4 %	4 %	95 — 98	95 — 99	..	..	..	4 1 8
40,000	St. James' and Pall Mall Electric Light, Ord.	5	14½%	12½%	10 %	10 %	7 — 8	7 — 8	..	..	..	6 5 0
20,000	Do. do. 7 % Pref. 20,001 to 40,080	5	7 %	7 %	7 %	7 %	6¾ — 7¼	6¾ — 7¼	..	..	..	4 16 7
150,000‡	Do. do. 3½ % Deb. Stock Red.	100	3½%	3 %	3½%	3½%	86 — 90	86 — 90	89	..	..	3 17 9
12,000	Smithfield Markets Electric Supply, Ord.	5	4 %	4 %	Nil	Nil	¼ — ⅜	¼ — ⅜	..	..	..	Nil
50,000	Do. do. do. 4 % Deb. Stock	Stock	4 %	4 %	4 %	4 %	68 — 72	68 — 72	..	..	..	5 11 1
65,000	South London Electricity Supply, Ord.	5	4 %	4 %	3 %	4 %	2⅜ — 2⅞	2⅜ — 2⅞	47/6	..	..	6 19 2
120,000	South Met. Elec. Lt. & Power, Ord.	1	Nil	2½%	2½%	2½%	⅜ — ½	⅜ — ½	..	..	..	4 0 0
117,968	Do. do. 7 % Pref.	1	7 %	7 %	7 %	7 %	1 5/16 — 1 7/16	1 5/16 — 1 3/8	..	..	..	5 12 0
200,000	Do. do. 4½ % 1st Deb. Stk.	100	4½%	4½%	4½%	4½%	100 —103	100 —103	102	..	..	4 7 5
80,000	Urban Electric Supply, Ord.	5	5 %	5 %	5 %	5 %	¾ — 1	¾ — 1	..	..	..	20 0 0
60,000	Do. do. 5 % Cum. Pref.	5	5 %	5 %	5 %	5 %	1¾ — 2⅛	1¾ — 2⅛	..	..	..	10 10 6
200,000	Do. do. 4½ % 1st Mort. Db. Stk. Red.	100	4½%	4½%	4½%	4½%	82 — 85	82 — 85	..	..	..	5 5 11
110,000	Westminster Electric Supply, Ord.	5	14 %	18 %	12 %	10 %	7⅛ — 8⅛	7⅛ — 8⅛	8¼	..	..	5 17 8
81,279	Do. do. 4½ % Cum. Pref. (Original 5 %—Red. to 4½ % from 31st Dec., 1905)	5	5 %	5 %	4½%	4½%	5⅛ — 5⅜	5 — 5⅛	..	..	— ⅛	4 1 10

* Unless otherwise stated, all shares are fully paid. † Quotations on Liverpool Stock Exchange. ‡ Interim Dividend.

Bank rate of Discount 2½ per cent., May 28th, 1908.

REVIEWS.

Introduction to the Study of Electrical Engineering. By Henry H. Norris. London: Chapman & Hall. Price 10s. 6d. net.

Mr. Norris's method is to regard electrical engineering as consisting "in the industrial application of magnetic and electrical principles," and he further claims in his preface that "the student in approaching the subject should have personal knowledge of the *things* and *phenomena* involved before any *reasons* can be ascribed."

The author opens with an introductory chapter upon power transmission, and the production of light, including the incandescent lamp, the enclosed arc, the mercury vapour lamp, and the Moore vacuum tube lamp. Then follow a few cursory notes on electrolysis, with diagrams illustrating the decomposition of water, the refining of copper, and a storage battery. Next comes a section devoted to the transmission of intelligence, with diagrams of simple telegraph and telephone circuits. The introductory section deals with the production of heat, and illustrates a resistance type of heater and a carborundum furnace.

Mr. Norris compresses into 34 pages an account of the historical development of the industry. As a comprehensive summary for the student well grounded in electrostatics and in elementary magnetism, the first 10 pages are really admirable. But of themselves they do not suffice, nor must the pages allocated to the "period of commercial development" be considered as aught but a "tabloid" form of knowledge.

Dealing with electric and magnetic quantities, we have again the setting-out first of the phenomena, and experiments of an advanced nature. In particular must be cited an experiment (page 56) showing a Faraday disk type of generator driven by a belt, the input power being measured by a transmission dynamometer, and the output power on a wattmeter. (It is only a matter of 270 odd pages further through the book before electrical measuring instruments are dealt with.) So also Mr. Norris prefers to treat first the volt, ampere and ohm as fundamental units, proceeding eight pages later to describe the C.G.S. system.

Next follows (Chapter III) a description of the materials of electrical engineering, naturally much compressed, particularly in regard to hysteresis, but well written so far as it goes.

Chapter IV deals with the electric circuit. First come the outdoor circuit and high-tension transmission lines, lightning arresters receiving more attention than underground cables, followed by several notes on alternating-current circuits, all worthy of expansion.

In Chapter V, entitled "Magnetic Circuits," the four circuits of a four-pole motor receive priority of treatment before single magnetic circuits. In this chapter the excitation of generators is discussed. In view of what has been said of the author's practice in arrangement, the reader will not be surprised to learn that the construction of electric generators forms the subject of the succeeding (sixth) chapter, and outline diagrams of alternators precede D.C. armatures, commutators and field coils.

The remaining chapters contain several interesting features. Thus Chapter VII (generators) gives the American Institute of Electrical Engineers' definitions as to regulation, and rules as to temperature rise on various ratings. Chapter VIII contains, *inter alia*, a brief note about the constant-current transformer, a useful device practically unknown in England. But further indications need not be given—the intelligent reader will be able to estimate for himself the matter dealt with in the dissertation on power stations, or electric lighting and heating, or instruments. Switchgear should, of course, have had a special section to itself.

The book is readable, and may be commended to those who require, or who can be satisfied with, a cursory and in no way detailed review of electrical work. It is a suggestive adjunct to the library of the student who has been *introduced* to electrical engineering along the lines of the English technical school or college. But for anyone else, who may be without such equipment, its technical value is, in the reviewer's opinion, *nil*. Agreeably written, it is an introduction to knowledge which is as a house builded from the gables downwards. While it is well illustrated, its deficiencies as regards what we consider as the bed-rock upon which foundations may be laid would certainly arouse the ire of a certain past-president of the I.E.E.

Of course, all men cannot be moulded to the same type, and there certainly cannot be only one correct specification for a course of preparation in electrical engineering. Mr. Norris's book may indeed have been evolved by the very nature of the local demand for an "electrical engineer," hustled up—we should say introduced—to that attainment through an introduction which assumes much, explains little, and proves even less.

Telegraphic Systems, and other Notes. By Arthur Crotch. London: Chas. Griffin & Sons. Price 5s. net.

At the present time there is a fairly large number of books relating to the practical and theoretical application of electricity and magnetism to the transmission of intelligence from place to place, by means of divers telegraph systems; but nearly all these books suffer in a greater or less degree from certain defects which prevent them from filling exactly the needs of the student or the practical telegraphist. The engineer, having achieved a certain amount of preliminary knowledge, desires to add to it in respect of the practical working of the more complex systems, which, with the object of obtaining greater facility for dealing with telegraphic traffic, are being introduced from time to time; but he does not wish to be under the necessity of filling his mind with a mass of prolix verbiage, figures, algebraical formulæ, or advanced theoretical arguments, and he also must have a certain regard for economy in adding to his library.

The author of this book, the fifth of a series on similar subjects from his pen, has evidently appreciated this need at its true value, and Messrs. Griffin are to be congratulated on adding to their series of text-books one which should command a ready sale amongst those for whom it is obviously intended.

In the preface, the author states that he aims at conciseness, and he certainly achieves this aim, with, however, a certain risk in one or two places of loss of clearness. He states that he assumes an elementary knowledge of the more simple systems of telegraphy, but we think that such an assumption may, at times, be carried a trifle too far, from the point of view of the student. In certain cases he makes use of the expression "it is obvious that . . . . ," whereas from our acquaintance with students generally, we have reason to think that it is seldom, if ever, *obvious*. In one sense, however, it is quite possible that this may be better indirectly for the obtaining of real knowledge, as opposed to the mere acquisition of facts and data sufficient for the passing of an examination (although we doubt whether this was the object in the author's mind), by causing the student to think for himself a little and to deduce facts logically rather than accept them merely because someone says they are facts. We feel, therefore, that this book might have had a little more space devoted to some recapitulation of elementary facts which are given at length in many text-books; the more so because of the vast amount of space which has been saved in comparison with many other books, whose bulk (and price) is increased out of all proportion by embodying an immensity of information regarding fundamental laws, units, &c., which is practically axiomatic. In such books also there is a large amount of information regarding historical and obsolete apparatus, all of which is quite unnecessary save in works devoted solely to such purposes.

Having said so much, however, we must say that this book is a particularly good one, and further, the author has in it embodied one or two details which seem to us to be unique. For example, we do not remember having previously seen his method of consecutive diagrams illustrative of the rather complex conditions attached to quadruplex telegraphy, nor do we remember any information showing the development of the repeater; nor is there elsewhere, so far as we are aware at the moment, such a concise description of the sounder silencer apparatus used at repeater stations. Generally speaking, the many diagrams illustrating the

book are well drawn, but we should like to see in this book, as in others, the diagrams drawn upon folding leaves, arranged so that the reader could keep a diagram in front of him whilst reading the letterpress relating to it without being under the necessity of turning back so frequently for reference, if such could be arranged for without unduly increasing the cost of production.

The descriptions of the more recently introduced systems, such as the Baudot (if that may be termed recent) and Murray, are very concise and clear, if brief, and this remark also applies to the chapters on Submarine and Wireless Telegraphy. But when the reduction of bulk is of importance, we should like to know why such a large amount of space is devoted to the description of the Delaney Multiplex, a system which is now quite obsolete. It may be that this was intended to lead up to the descriptions of the other systems which depend upon synchronisation, or to the use of a distributor; but we think that this was hardly necessary. The space could, we think, have been devoted better to a comparison of the relative advantages of the Bridge and the differential Duplex systems, upon which a good deal depends.

On the whole, we can thoroughly recommend the book to those who are studying for the City and Guilds examinations, and also those who are desirous of qualifying for the various Post Office departmental examinations, to the general student, and to the telegraph engineer who needs to have always available a handy book of ready reference dealing with the work with which he is in daily touch.

Field Telephones for Army Use. By Lieut. E. J Stevens, R.A. London: Crosby Lockwood & Sons Price 2s. net.

It is astonishing how from day to day the number of books which deal with the subject of telephony in one or other of its many aspects continues to increase. From the bulky tome which at a price of 15s. or thereabouts helps a student to assimilate certain of the more abstruse and complex laws that govern the transmission of speech by means of a more or less perfect conductor, and which is replete with mathematical formulæ that would absolutely bewilder a layman, down to the modest little manual which for the sum of 1s. 6d. or so instructs the layman how to fix a telephone circuit between his—or anyone else's—suburban drawing-room and back kitchen without the help of any mathematics or formulæ whatever—all these works have more or less justification for their publication, for either they have something new to say or to add to what is known of the science, or else they say something which is old, but is clothed in such a way as to make it acceptable to those students or readers to whom the previous works on the subject did not appeal.

But this book, which belongs to a point somewhat near the latter end of the scale alluded to above, does not seem to possess either of the foregoing reasons to justify its appearance. The author, however, mentions in his preface that he has found a need in the army which the book is intended to fulfil. To army students it is, therefore, addressed, and to such it may be useful, but we hardly think it will prove of like value to the general run of civilian students, whose needs will be better met by many other of the text-books already published. One or two chapters, however, will repay reading, for the latter portion of the book, which describes portable telephones, contains several good diagrams and descriptions of apparatus not generally met with elsewhere, as well as particularly good drawings and descriptions of the solid-back and capsule transmitters.

The first part of the book contains chapters on elementary electricity and magnetism, in which we think more space might have been devoted to the effects of local action and polarisation in batteries, to the exclusion of what appears to us to be an unnecessary summary of facts which surely ought to be obvious to the least learned. For instance, in connection with the causes of failure in batteries and their remedies, we read the following: "A battery may fail because of 'insufficient solution.'" Remedy—"*Pour in more!*"

This leads us to imagine that the author is not without a sense of humour, for besides the example quoted, we read on page 37 that "replacement indicators have the disadvantage of the attendants' forgetting to replace them, causing extra wear on the stair carpet when they go to see when they are wanted!" We do not think that the method shown on page 83 for tapping a telegraph circuit would be very satisfactory, for although the telegraph stations would doubtless remain unaware of the presence of the tapping telephones, yet the latter could hardly fail to suffer disturbance from the working of the former, particularly if the circuit were a busily operated one.

The appendix contains good matter, which is well worth perusal, but surely the table of specific inductive capacities might have been replaced by one which would have been regarded as correct according to our present knowledge.

FILING ENGINEERING NOTES.

By R. BORLASE MATTHEWS, Wh.Ex., A.M.I.C.E.

Those who are engaged in electrical engineering, as well as in many other occupations, cannot but accumulate in course of time a very large and varied collection of technical data, general information, reports, drawings, books, &c., and without some effective system of indexing it is obvious that such becomes but a heterogeneous mass of detail, from which it is next to impossible to extricate exactly what is required from time to time. The older methods of filing, mostly dependent upon an alphabetical classification, are inadequate to cope with the difficulty, as either only the very general heads of the filed matter are dealt with, or else the index is itself so extensive and complicated as to hamper the prompt location of the subject desired. These difficulties, however, seem to have been overcome in the Dewey Decimal Relative Classification Indexing System, which, though little known in this country, has been very widely adopted in America, where it is almost universally applied in libraries, and is spreading quickly in professional and commercial circles.

In brief, the system consists in the division of the entire field of knowledge into nine main classes (numbered by the digits 1 to 9), and any data of such general character as to belong to none of these nine classes are indicated by a cipher, and form a tenth class. These main classes are as follows:—

100 Philosophy.	600 Useful Arts.
200 Religion.	700 Fine Arts.
300 Sociology.	800 Literature.
400 Language.	900 History.
500 Natural Science.	000 General.

Each class is similarly divided into nine divisions, a tenth division, indicated by a cipher, being again employed to indicate matter in this class too general to be included in any one of the other nine divisions. For example, Class 6 above, Useful Arts, is divided as follows:—

610 Medicine.	640 Domestic Economy.
620 Engineering.	670 Manufactures.
630 Agriculture.	690 Building.

The divisions are each similarly divided into nine special sections and a general section. Thus, the first sub-division of Division 2, Engineering, is 621 Mechanical Engineering.

Each of the sections is divided into ten sub-sections. For instance, Section 1, Mechanical Engineering, provides sub-sections:—

621·1 Steam Engineering.
621·3 Electrical Engineering, &c.

The process of sub-division may be repeated in the same manner as often as is found necessary. Sub-section 3, Electrical Engineering, for example, is divided into ten classes, each class into ten divisions, each division into ten sections, and each section into ten sub-sections, each of which can be again divided into ten parts if necessary.

In accordance with this system Electrical Engineering is assigned the number 621·3, this being Class 6 (Useful Arts), Division 2 (Engineering), Section 1 (Mechanical Engineering), Sub-section 3 (Electrical Engineering). All matter on electrical engineering is, therefore, filed under the number 621·3 with its further sub-divisions. In order to avoid

unnecessary repetition in use, the number 621 can be replaced by the letter E (Engineering), and two noughts added after the 3, thus making the general head for Electrical Engineering E 300, and the extension can then be carried on from this point.

Materials of the Useful Arts are assigned the number 600·1, this being Class 6 (Useful Arts), Division 0, Section 0 (on account of the general character), Sub-section 1 (Materials). As was done in the above-mentioned case, to save trouble the number 600 can be replaced by the letter M (Materials), and two noughts added after the 1, thus making M 100 the general head for Materials of the Useful Arts.

It should be borne in mind at all times that the letter E represents 621, likewise the letter M represents 600, so that matter under these classifications may find its proper place in relation to matter outside the field of engineering.

To index and file an item, it is marked with its classification number, and placed in the numerical order thus indicated in the general collection or file to which it is attached. To find an item, the subject index is consulted for the classification number, which gives the numerical place in the collection of all the items that the collection contains under the head sought.

Thus: Matter treating of alternating-current generators (E 312·1) follows direct-current motors (E 311·4), and also precedes transformers (E 331).

Matter treating of varnish as an insulating material (M 117) will follow thermometers (537·51), since M represents 600; likewise it will precede direct-current generators (E 311·1), since E represents 621.

It will be seen that a prominent feature of this method is, that it is a relative index, with a subject classification so numbered that reference is compact, accurate, and quickly made. As it is a decimal system, it admits of an almost unlimited sub-division, and forms a very elastic arrangement whereby new material can always be inserted in its correct position relative to any other data it may be filed with, and thus it can very readily be found when required.

Of course, given these general lines to work upon, anyone could evolve a classification system of his own. The one referred to is not perfect, but, nevertheless, it is the outcome of considerable experience, so that it would be well for others to adopt it as it stands, especially as such procedure would carry with it the advantage of uniformity; a by no means invaluable feature of the Dewey system is that, knowing the system, a stranger can at once find information required in any collection of books or notes classified on this particular basis.

The actual mechanical details of filing are a matter for the discretion of the user. The best way is probably to use a separate stout paper folder for each item of the same section, keeping the folders either in a vertical file or in cases such as are used for filing letters, but without indices. A list of the classes, divisions, &c., in numerical order, and also an index alphabetically arranged would be required. The latter may be in the form either of a card index, or of a loose-leaf book. For general library work an index is published; the extension for the electrical engineering section is not, however, carried out far enough. The General Electric Co., of America, and the British Thomson-Houston Co., Ltd., of this country, have printed such an extension of the index for the private use of their departments, but it is not available to the general public.

The classes, divisions and sub-sections of the electrical engineering extension are given below, and will assist anyone who desires to initiate this system of filing for his own notes. If any further information is desired as to the sections, divisions, or other matters, the author (who has employed this system with great success for his own notes for some time past) will be pleased to give it:—

621·300 } *Electrical Engineering.*
E 300 }
E 310 Dynamos.
E 320 Applications.
E 330 Static Transformers and Induction Devices.
E 340 Conducting System and Supporting Devices.
E 350 Appliances and Batteries.
E 360 Instruments and their Use.
E 390 Miscellaneous.

E 310 *Dynamos.*
E 311 Generators and Motors—Direct Current.
E 312 Generators and Motors—Alternating Current.
E 313 Rotary Converters.
E 315 Railway Motors.
E 318 Composite Machines (including Dynamo as a part.)
E 320 *Applications of Electricity and Central Stations.* (Including Generating and Sub-Stations.)
E 321 To Lighting, Stations for Lighting only.
E 322 Transportation, Stations for Railway only.
E 323 Power Transmission, Stations for Power (other than Railway and Lighting), also combined Stations.
E 324 Mining, Steelworks. Also see E 318·41 Coal-Cutters.
E 325 Hoisting, Pumping, Blowing, Dredging.
E 326 Heating, Cooking, Welding. Also see E 357 for Appliances.
E 327 Machinery and Machine Tools. Also see E 318·7.
E 328 Electrolysis, Chem.-Technology, Elec.-Metallurgy.
E 329 Miscellaneous Applications.
E 330 *Static Transformers and Induction Devices.*
E 331 Transformers.
E 332 Induction Regulators and Starting Compensators.
E 336 Reactive coils.
E 337 Induction coils.
E 338 Condensers.
E 339 Miscellaneous.
E 340 *Conducting System and Supporting Devices.*
E 340·1 Theory and calculation of lines.
E 340·2 Systems of Distribution.
E 340·3 D.C. Systems.
E 340·4 A.C. Systems.
E 340·8 Wire Tables.
E 341 Conductors in General.
E 342 Railway Line Devices and Car Wiring.
E 343 Conduits and Special Conductors.
E 346 Insulators.
E 347 Supporting System (excluding Insulators).
E 350 *Appliances and Batteries.*
E 351 Arc Lamps, Fixtures, &c.
E 352 Incandescent Lamps, Fixtures, &c.
E 353 Switches and Controllers.
E 354 Switchboards.
E 355 Rheostats and Resistances.
E 356 Circuit-breakers, Arresters, Fuses, &c.
E 357 Heating Appliances, see E 326.
E 358 Batteries.
E 359 Miscellaneous.
E 360 *Measuring Instruments and their Use.*
E 361 Pressure Instruments and Measurement of E.M.F.
E 362 Current Instruments and Measurement of Current.
E 363 Resistance Instruments and Measurement of Resistance.
E 364 Power Instruments and Measurement of Power.
E 365 Frequency Indicators.
E 369 Miscellaneous Instruments.

600·100 } *Materials of the Useful Arts.*
M 100 }
M 110 Products of Chemical Technology.
M 120 Carbon and Hydrocarbon Compounds.
M 130 Iron and Steel.
M 140 Metals, other than Iron and Steel.
M 150 Minerals and Mineral Products. (Does not include Classes M 120, M 130 and M 140.)
M 160 Wood, Paper and their Compounds.
M 170 Leather, Rubber and Moulded compounds.
M 180 Textile Materials, Fabrics, Cordage, &c.
M 190 Miscellaneous Material.

Sub-Sections.

(Common to all Sections.)

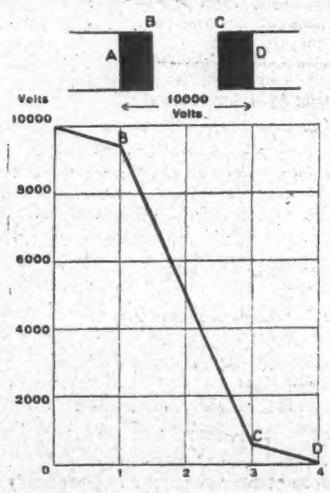
01 Theory, Design and Calculation.
02 Commercial Data (Costs, Sales, Price Lists, &c.).
03 Testing Data. Methods of Test.
04 Production Data. Shop Practice.
05
06 Installation, Operation and Maintenance.
07
08
09 Description, Photos and General Reports.

Fires and their Causes.—Referring to Mr. Lacey Downe's letter on the above subject, and our notes in the issue of 28th ult., the May-Oatway Fire Appliances, Ltd., inform us that their automatic alarm system has signalled over 60 outbreaks since the commencement of the operations of the company with their standard automatic compensated detector. Particulars of 39 causes of fires are given, and it is worthy of note that electricity is only responsible for two of them. One of these was caused through a short-circuit brought about by a leaky roof allowing rain to get into the building and saturate wires in casing. The short-circuit caused sparks to fall and set fire to an accumulation of cotton fluff along a ridge. Probably the fuse on this particular circuit was of too high carrying capacity; otherwise very likely there would not have been sufficient fire to operate the detector.

SWITCH AND TRANSFORMER OIL.—II.

By "GLUCKAUF."

Oil as a Transformer Insulator.—Air-cooled transformers must of necessity suffer from all the destructive effects that air and moisture have on insulating material. Ordinary insulating varnishes all deteriorate, due to oxidation, in the course of time, even 10 to 12 months being sufficient to lower the disruptive strength by quite an appreciable amount. This "ageing" of the varnish appears to obey a straight-line law more or less. Then again, with pressures of 10,000 volts and over, "ozone" and nitric acid troubles become very serious; more than one high-tension alternator has been almost entirely rewound within 12 months of its installation, due to nitric acid having destroyed its insulation. As no trace of acid was found in the insulation material on the unused coils, which was of the very best quality, it seems fairly clear that moisture and ozone had together played an important part in developing the nitric acid and sulphuric acid found in the machine windings after some 12 months' use. The insulation of an air-cooled transformer would obviously be exposed to the same danger, and as good ventilation also implies increased oxidation and the more chance of the windings being well ozonised at the same time, there can be little or no doubt that the proper thing to do, is to exclude air from the windings entirely by immersing them in oil. Provided the oil is kept free from dust and moisture, its insulating properties do not suffer by "ageing," and it can be readily



changed and renewed if desired. The oxides of nitrogen are always produced when a brush discharge takes place in air, and recent experience seems to point to ozone troubles beginning at a voltage as low as 2,000 (see Mr. Highfield's article, *Electrician*, Vol. 54, p. 573), nitric acid, of course, being formed as a result. Air breaks down, and a brush discharge takes place if the potential gradient exceeds 18,000 to 20,000 volts per cm. (alternating current), and in view of temperature rise it is doubtful if 15,000 volts per cm. should be exceeded, or even allowed, in practice, especially with alternating current.

In this connection, Fessenden and Tesla's experiments as illustrated in the figure, are of great interest. The distance between the two electrodes A and D is 1 cm., and the alternating pressure 10,000 volts; taking 15,000 volts per cm. as the dielectric strength of air under the above conditions, this would allow a 50 per cent. margin of safety. Now introduce two glass plates as shown in black, each plate being $\frac{1}{4}$ cm. in thickness. The voltage gradient will be inversely as the capacity, so that, since the specific inductive capacity of glass is eight times that of air, the voltage between B and C as shown on the curve is now 8,890, which equals 17,780 per cm., thus exceeding the limit allowable for air, and hence under these conditions a spark will now pass which will rapidly heat up the glass and cause breakdown. In the above experiment the introduction of an insulator (glass) of higher specific capacity has actually weakened the insulation by raising the potential gradient in the air-gap above the limit allowable for air. It tends to show that uniformity in texture of insulating material is desirable, which, of course, is readily obtained with an oil insulator. The above experiment also shows the importance of excluding air bubbles from the test sample of oil, as already mentioned.

One of the difficulties with oil insulation is the dissolving effect that the heated oil has on the insulation material, and this is responsible for most of the heavy viscous deposit sometimes found at the bottom of the transformer case after some months use. This deposit is a very good insulator, but at the same time it is objectionable, as it impedes the circulation of the oil, and thus affects the cooling of the transformer by reason of its choking up the ventilation spaces. Cotton, Presspahn, paper and oiled linen tape are all excellent insulators when well dried in a vacuum, and then thoroughly impregnated with oil, and the use of any varnish is unnecessary and objectionable, be the base what it may — asphalt, shellac, linseed oil, or coal-tar product, as the oil has a solvent action on all these materials. The solvent action of mineral oil on dried linseed oil is very slight, but the use of linseed oil compound is objectionable owing to the ready manner in which this oil takes up oxygen. Again, any cementing compound used for sticking parts of the transformer insulation must be quite free from any tendency to become dissolved by the oil; hence the objection to the use of built-up mica insulation where shellac is usually the cementing medium. In repairing transformers that have been in use some years it will frequently be found that the shellac is entirely dissolved, leaving the mica in a loose flaky condition. If the insulating varnishes and cementing compounds are going to be dissolved out when the transformer is in use, it is obviously much better to avoid their use altogether and thus prevent any possibility of overheating due to the pasty deposit blocking up the ventilation spaces. This simply means thoroughly drying the finished windings in a vacuum oven and then at once putting them in the oil cases under oil, the cases being sealed down so as to exclude dust and moisture. Rubber and rubber compounds must be carefully avoided, as they are all readily attacked by the oil; ebonite and vulcanite come under the same bane as being rubber compounds. Vulcanised fibre, on the other hand, is not attacked by oil, but it readily absorbs moisture, and must therefore be very thoroughly dried. Well-seasoned and thoroughly dried wood, when oil impregnated, is an excellent insulating material for coil flanges, &c.

Moisture and Dust.—The moist condition of the English climate does not seem to be guarded against to the extent that is advisable, seeing that the air quite frequently contains as much as 60 to 80 per cent. of moisture (saturation point being, of course, taken as 100) at normal temperatures of, say, 60° F. (16° C.). Motor insulation that had been used for years with success in America utterly failed in English practice entirely owing to the moist atmospheric conditions. Cotton will readily absorb about 10 per cent. of moisture from the air, and wood and paper are equally hygroscopic. Dried wood will absorb from 15 to 20 per cent. by weight of moisture in about 48 hours, if exposed to ordinary atmospheric conditions, while paper usually has at least 5 per cent. (by weight) of moisture in it, as readily noticed if an ordinary piece of paper is dried before a brisk fire. The insulating qualities of oil rapidly deteriorate if exposed to moisture; while, as already pointed out, dust, by being carried into the winding space, is liable to set up "arcing." It is, therefore, most important that transformer and switch cases should be absolutely moisture and dust proof, though not necessarily pressure tight.

The carrying-in of cables through plain bushes without packing glands may reduce the cost of the apparatus, but it is certainly very bad practice, although unfortunately very frequently done. Dust, settling on the windings during construction, can only be thoroughly removed by the use of compressed air or vacuum-cleaning apparatus, the use of brushes and dusting cloths merely driving a considerable portion of the fine dust in between the windings. This dust question is far too often neglected, the windings being left about the shops in the cases with the lids off, so that the whole transformer is simply choked up with dust, which is frequently responsible for a breakdown that is blamed on to

the insulating oil. A light transformer case lid can readily be made moisture and dust proof, and, at the same time, loose, so as to avoid any pressure being developed inside the case in the event of a bad short taking place. When water-cooling pipes are placed in the upper portion of the case they must be well submerged, otherwise moisture condensing on the exposed cooling pipe will reach the insulating oil.

With a vacuum drying plant there is no difficulty in thoroughly removing all moisture from the insulating material, before oil impregnating the same, without using a temperature high enough to in any way damage the insulation. With a 28-in. vacuum, corresponding to an absolute pressure of nearly 1 lb. per sq. in., the boiling point of water is 38° C., so that vacuum drying at, say, 60 to 70° C. will rapidly remove all traces of moisture, without the slightest harmful effect on the insulation.

The usual working temperature rise allowed for cotton-insulated machine windings is 40° C. (the German rules allow 50° C. for rotating windings and 10° C. higher, *i.e.*, 60° C. for stationary windings) to 45° C. for cotton, and about 10° C. higher for paper, so that a drying oven temperature of even 70° C. is quite safe, as the above temperature rises are based on an air temperature of 35° C. In fact, in view of the very great advantages obtained by vacuum drying, it is surprising that the use of vacuum ovens in electrical works is not universal, the saving in the length of time required for drying out the insulation being very considerable.

It is important that any raw fabric, cotton, &c., be vacuum dried before it is impregnated; otherwise, not only does the impregnating compound retard the moisture from being dried out, but the moisture also tends to cause the insulation compound (especially with varnish compounds) merely to coat the surface and not enter the pores at all.

Electrostatic Attraction.—As is well known, the mechanical pressure on the insulating material between two high-tension conductors due to the above cause may be very considerable.

The attraction is inversely as the square of the thickness and directly proportionate to the square of the voltage.

At 20,000 volts, with 0·2 in. of insulation, the pressure is approximately 2 lb. per sq. ft., which blow, being repeated twice in every cycle, must, to some extent, destroy the insulation material. Some tests made by the writer with wire-gauze electrodes separated by a sheet of phonograph record wax, show that, even at 5,000 volts, the static pressure is sufficient to distinctly mark the wax with the impression of the gauze. Insulation oil appears to very considerably damp or reduce the effects of the electrostatic pressure on the insulating medium. With very high voltages this may possibly be of great importance.

ELECTRICAL INVESTMENTS ON THE EUROPEAN CONTINENT.

A certain amount of interest always attaches to the annual report of the Bank für Elektrische Unternehmungen (Bank for Electrical Enterprises), of Zurich, though, unfortunately, the report for 1907-8 is less instructive and prophetic than some of its predecessors.

It is necessary to explain that the bank is a kind of industrial trust, having a combined share and loan capital amounting to £3,180,000. The report states, in the first place, that the city and communal electricity undertakings closely associated with the bank were only slightly affected by the general decline in business, and their receipts were only subject to relatively small fluctuations. If a reduction in the sale of power had to be admitted in the case of some works, owing to the restriction of business activity in various branches of trade, compensation was obtained from the variety of the installations and the increase in the number of connections. Not only so, but the diminution in activity experienced in industrial branches, has led to the modernisation of works and augmentation in the economy of working, and the introduction of electrical operation. Almost all the works are in course of development, as the area of supply is constantly being extended by the establishment of connections with new communes and by the continual expansion of the existing networks. The demand for energy for lighting purposes is is stated to be continuously increasing, especially on account of the introduction of metallic-filament lamps. As far as the sale of power for tramway purposes is concerned, the report states that a reduction in the large towns only occurred in isolated cases, as the passenger traffic is constantly advancing, and the receipts of those lines in which the bank is interested experienced an increase all round; but higher wages and dearer coal in these latter instances occasioned a considerable augmentation in the working expenses. Yet these circumstances have not prevented the companies from paying the same dividends as in the preceding year, notwithstanding the growth of the share capital.

Manufacturing concerns.	Nominal value of share.	Quotation on June 30th, 1907.		Quotation on June 30th, 1908, including current dividend.	Yield on the basis of the last dividend.
		Berlin.	Zurich.		
					Per cent.
Allgemeine Co.	1,000 marks	198 per cent.	2,370	2,620	5·86
Brown-Boveri, Baden	1,250 francs	—	2,300	1,990	7·35
Working and Trust Companies.					
Strassburg Electricity Works	1,000 marks	—	2,980	2,800	5·35
Genoa Electricity Works	250 lire	—	525	480	5·30
Italian Tramway Union	500 „	—	660	680	5·60
Barcelona Electricity Works	500 pesetas	—	570	545	5·75
German Transmarine Electricity	1,000 marks	146 per cent.	1,826	1,820	6·40
Motor Applied Electricity	500 francs	—	626	630	4·80
Franco-Swiss Electric	500 „	—	500	430	3·50
Swiss Electrical Industry	5,000 „	—	6,150	6,700	4·20
Light and Power Investments...	1,000 marks	116 per cent.	—	113 per cent.	6·20
Electrical Enterprises	1,000 „	125 „	—	124 „	6·45
Bank for Electrical Enterprises	1,000 francs	—	1,765	1,865	5·30

As an illustration of the effect produced by the changes in the condition of trade on the quotations of the shares of large electrical undertakings, the bank embodies the foregoing table in its report. The bank also gives details of the dividends paid by the most important undertakings in which it is interested. These are as undernoted :—

	1907.	1906.	1905.
	Per cent.	Per cent.	Per cent.
Genoa Electricity Works	10	10	10
Italian Tramway Union	7½	7½	6½
Seville Electricity Co.	8	8	8
Barcelona Electricity Co.	7½	7½	7½
Strassburg Electricity Works ...	12	12	11
Bitterfeld Electro-chemical Works	9	9	7
Rheinfelden Power Works ...	8	8	7
German Transmarine Electricity...	9½	9½	9
Solingen Secondary Railway ...	5½	5½	5
Motor Applied Electricity ...	6	6	6
Silesian Electricity and Gas ...	9	8½	8
Watt Co., Glarus	5	5	—
Kubal Electricity Works	6	7	6

The final result of the bank's transactions during 1907-8 is represented by net profits amounting to £174,760, as compared with £150,160 in the preceding year, and a dividend has been declared at the rate of 10 per cent., as compared with 9½ per cent. in 1906-7, 9 per cent. in 1905-6, and 8½ per cent. in 1904-5.

RAILWAY CHARGES IN CONNECTION WITH THE ELECTRICAL INDUSTRY.

[COMMUNICATED.]

Although large sums are paid annually for the carriage of electrical goods, apparently little interest is taken to ascertain whether the charges made by the railway companies are correct or not. The charges for railway carriage on electrical goods are, as a rule, heavier than on many articles of a corresponding kind used in other trades. Particularly is this the case with sundries. Electrical goods are generally chargeable under Classes 1, 2, 3 and 4. To give an idea as to the relative rates, one may take for an example the rates per ton from a certain place in Yorkshire to London.

First class.—Accumulator plates, 31s. 8d. per ton.

Second class.—Accumulators, dynamos, and motors, 39s. 4d. per ton.

Third class.—Electric arc lamps, excluding globes and carbons, 45s. 6d. per ton.

Fourth class.—Incandescent lamps, 55s. 10d. per ton.

Below are given a few instances where overcharges are frequently made, owing to the railway people's lack of knowledge concerning the electrical trade.

Accumulator plates are in many instances charged as batteries at the third-class rate. The reason they are charged too much is either that they have been consigned wrongly as battery plates, cell plates, or owing to the railway companies' officials not knowing the difference between the plates and a battery. Accumulators, dry, come under Class 2, but these again are overcharged and rated under Class 3. The reason in this case is that the public often consigns accumulators as either cells or batteries, and the result is that they are paying more for carriage than there is any occasion to do.

The writer had to check a London firm's account for railway carriage a short time ago, and there were overcharges to the extent of three pounds in connection with accumulators and the plates for them. However, after a great deal of trouble, the amount was recovered from the railway company.

Consider for a moment the number of accumulators and accumulator plates that are sent from London every year, and if the percentage of overcharges is only as great as that mentioned above, a fair sum is netted by the railway people over and above the correct charge.

Dynamos and motors, in cases, are chargeable at second class; but in the event where they reach over 2 tons weight, why cannot they be charged at the mileage rates, the same as oil engines, and gas engines, and at a scale which is less than Class 2?

There is no doubt that both makers and users of electrical machinery have a grievance here against the railway companies, as it scarcely seems fair that one class of machinery should be catered for at a lower rate than another, which is in many respects similar both in weight and construction.

The mileage scale of rates mentioned above is based on the actual number of miles which the goods travel, and was at one time principally used for agricultural machinery; however, many other classes of machinery are charged at this rate, which, as a rule, is the cheapest rate for machinery.

In addition to the mileage rate there are plenty of special rates for machinery in operation.

Now these special rates (which are not mileage rates) are usually in force between stations where a goodly bulk of this kind of traffic frequently and regularly passes, and the difference in price between the special rate for machinery and the ordinary second-class rate is often great. It is only this year that these special rates for machinery have commenced to apply to dynamos, as previously they were debarred from this privilege, which is perhaps a greater one than appears on the surface.

Take, for instance, the second-class rate from a certain place to London; this is 39s. 4d., whilst the special rate is only 30s. per ton.; the difference is, therefore, equal to a good saving, and may benefit the trader much, especially if the traffic is heavy, so that it behoves him to see that the special rate is charged.

Another case where the trader is overcharged is in items under 3 cwt., or in what are termed smalls. These smalls the railways are allowed by law to charge from 5d. to 1s. 6d. more per package, and they have a scale to charge the items out, and this scale is termed the "small scale." One cwt. at 40s. would not be charged out as 2s. but as 2s. 7d., and any items under 3 cwt. are chargeable under this small scale.

When sending two or more packages from the same firm to the same consignee on the same day, see that they are lumped together as below:—

	cwt.	qrs.		
1 box electrical instruments	1	2	at 55s. 10d.	
1 " "	1	2	at 55s. 10d.	
	3	0	at 55s. 10d.	= 9s. 1d.

and not:—

1 box electrical instruments	1	2	at 55s. 10d.	= 4s. 10d.
1 " "	1	2	at 55s. 10d.	= 4s. 10d.
				9s. 8d.

When lumped together it will be noticed that some saving is effected, and it is better for the trader to lump items under similar circumstances together, and so obtain the benefit. Although the saving does not amount to much on one consignment, if several lots are sent daily the saving is then considerable.

No doubt it will be some time before the electrical trade gets the railway companies into line with respect to carriage charges and obtains equal treatment with other trades. Better rates are being given now than in the past, and that is some consolation. The main reason why the rates for electrical goods are sometimes not uniform with other trades for similar goods is that the electrical industry is practically a new industry, and it is left for the electrical trader to see that the railway rates for his goods are brought to the same level as for other traders' goods.

SICK AND BENEFIT FUNDS FOR TRAMWAY EMPLOYES.

By A TRAMWAY ENGINEER.

There appears to be a tendency nowadays to regard the employés of a tramway department as a distinct and unique class of individuals never before existing, which requires a certain amount of attention almost approximating to faddism in order to render it capable of executing its duties. One of these developments seems to be the notion that sick and benefit societies founded in the interests of tramway employés should be supported out of employers' funds, which in the case of tramway departments owned by corporations really means a subsidy of public money.

A case in point is the recent request made by the tramway employés of the Manchester Corporation, that their Benefit Society should be supported out of the Corporation funds, and it is the writer's opinion, at any rate, that the Corporation pursued a very wise and commendable course in refusing to give any money to this object. In considering the question, it is worth while inquiring as to the difference that exists between tramways employés and any other set of men in municipal or public employ. We have the electricity department, the water department, gas department, scavenging department, highway department, policemen and many other classes of perfectly virtuous individuals, liable through illness to sudden deprivation of their incomes and working for a public corporation.

If all these bodies of men were to be possessed of benefit funds supported out of public money, the cost to the ratepayers would be enormous. If the relative conditions of pay, nature and hours of work are compared as between an average tramways department and the other sections of corporation work, it will be found that the tramway man stands in a very good position, and if given the option would almost certainly prefer his own job to that of any of the others mentioned. Moreover, the condition of employment of tramway men on the modern electric systems, which are now becoming almost universal, is far in advance of the onerous requirements that were in vogue under the old horse and omnibus systems. It is rather curious, therefore, that this essentially modern demand should have arisen among the most favoured class of corporation workers, and at a time when most of the hardships of tramway employment have disappeared; therefore, it must first and entirely be excluded from the question that tramway employés need special consideration not to be given to any other classes of employés, and it may

perhaps, be quite fairly argued that this demand has arisen from the fact that many of our large tramway systems are making handsome profits, and that the employé knowing this is desirous of getting hold of some of the money which is being turned over by the operation of the trams. It must be remembered, however, that the concern is the property of the ratepayer, and the profits arising are due to the patronage of the general public, chiefly ratepayers, and not to any special effort of the men; it, therefore, follows that any profit must go to the ratepayer, and the position is entirely different to that of a private concern, in which the individual owner can dispose of his profits according to his own scale of generosity. It will thus be in order to suggest that a private sick and benefit fund, or any other fund subsidised at the expense of public money, is a flagrant breach of municipal ownership. Public concerns have enough to pay in insurance premiums and other amounts to cover employers' liability, without going further and providing sick funds.

The question, however, of having a sick and benefit fund supported by the employés themselves is quite another matter, and is worthy of due consideration. It is very probable that, in a large concern, the benefits to be derived are more than if the men joined as a body one of the instituted orders of sick societies, owing to the fact that the expenses of management would be less in proportion when the numbers do not become too great. One thing, however, will be found—that a certain number of men will very frequently be on the sick list, and it is generally the same men who come on to the fund time after time, rendering abuse difficult to arrest. Moreover, it will be found that some men make a practice of joining as many sick societies as possible, and it has been found in some cases that men can draw considerably more in sick pay than they would receive for their ordinary daily work. Consequently, in drawing up the rules of membership of any sick or benefit society in connection with a tramway system, supported entirely by subscriptions from its own members, the influence of such "wasters" must be carefully guarded against.

Presuming that a sick fund is established amongst the men, it is very difficult to get them to realise that it is simply a form of mutual aid, and where some men through their misfortunes are more on the sick list than others, they naturally make a bigger draw on the funds than those who are healthy; and, furthermore, it is impossible for each member of the club to receive back anything approaching the sums he has paid in as contributions. This is entirely apart from the fact that it is problematic whether in the operation of such a privately constituted fund, any monies can be accumulated or properly invested. This should be taken into consideration in the method of establishing a sick fund, as there are so many friendly societies or sick clubs in existence with machinery in proper working order and having the ability to safely invest their funds. It would seem that some arrangement might he made to form a branch consisting of members in the tramway department; they would thus have the benefit of the long experience of these societies, a good deal of local control, and the very desirable result in all such sick funds of a maximum benefit for a minimum contribution.

As, however, the whole object of such societies is to do what the majority of men are unable to accomplish, namely, to save up for a rainy day, it will be encouraging the weakness of men if any subsidy is paid them out of public moneys; moreover, if each man could realise the fact that he does not get back a shilling for every shilling he pays, and that at any rate in the long run he gets less than the amount which he could obtain if he saved up and simply invested his money, then the need for such funds would be gone. If the men have good enough feeling amongst themselves to join together, realising they are helping one another, it is a good sign, and should not be discouraged, but the thrifty do not require it, and the lazy abuse it, so that a voluntary sick fund usually ends in a split and wind up.

There is a considerable tendency to Socialism of the latent type in these matters, and the Manchester Committee have shown a commendably bold front in refusing to be drawn in this matter.

Arc Lights as Moth Traps.—This year has been noted for its swarms of moths and butterflies, and, as usual, in several places the attraction of the electric light has been noted, especially where arcs are burned. The use of arc lights as traps is not indulged in by American authorities, but a special cable dispatch from Zittan, Germany, says:—"The Saxon authorities have discovered what would seem to be an excellent way to put an end to the caterpillar plague, which is having such a disastrous effect on the local forests. They have discovered a method to catch the brown moths that lay the eggs from which the caterpillars come in enormous quantities. They make use of what they call the electric light trap. This consists of two large and powerful reflectors placed over a deep receptable and powerful exhaust fans. The whole has been erected on top of the municipal electric plant. At night two great streams of light are thrown from the reflectors on the wooded mountain sides ½ mile distant. The results have been astonishing. The moths, drawn by the brilliancy, come fluttering in thousands along the broad rays of light. When they get to a certain distance from the reflectors the exhaust fans take up their work, and, with powerful currents of air, swirl them down into the receptacle. On the first night no less than 3 tons of moths were caught. It has been decided to build another trap on the Rathaus tower, and the fight will be continued."—*Electrical World.*

CONDENSING FOR SMALL ENGINES.

It has often been somewhat unwisely assumed by central station designers that the question of condensing *versus* non-condensing, was largely a matter of location of works, having reference to the difficulty and consequent cost of securing an adequate supply of water. In central stations of small size, however, it not unfrequently occurs that the actual gain in efficient running of the engine is more than balanced by the interest on capital commitment and cost of extra steam and attendance on auxiliary apparatus. It is an analogous case to that of a manufacturer whose attempt at economy consisted of displacing two small boys on a certain operation by a complicated automatic machine that needed a skilled man to look after it. The step would have been correct if there had been a bigger output.

The point is very well brought out in an article by Mr. W. E. Snow in the *Engineering Magazine* for May, on "The Cost of Power in Small Units." The particular value of this article is that it condenses data of actual costs of installation and operation obtained in over 30 small power plants situated in various parts of the United States. As the figures have been recently obtained, they are considerably superior to some of the text-book matter with which we are sometimes fed. Without going through the very complete tables with which the article is equipped, and which carry the argument right forward from the ascertained prices of the plant and the annual costs of operation scheduled under various items of expense, it is interesting to examine the comparison given of a small power plant of 75-H.P. capacity, installed on a condensing and non-condensing basis. The costs are allocated as follows:—

CONDENSING.

75-H.P. engine and condenser	$1,475
Engine and condenser foundation	450
Boilers and settings	1,100
Flues	154
Stack	360
Feed pumps	158
Piping	460
Heaters	148
Boiler house	850
Engine house	370
Coal pockets	470
Incidentals	650
	$6,645

NON-CONDENSING.

75-H.P. engine	$1,130
Engine foundation	345
Boilers and setting	1,100
Flues	150
Stack	420
Feed pumps	158
Piping	220
Heaters	142
Boiler house	970
Engine house	160
Coal pocket	525
Incidentals	450
	$5,950

We also find the cost of yearly operation of the plant to be as follows:—

CONDENSING.

Coal at $5.00 per ton	$1,910
Fixed charges at 11 per cent.	765
Attendance	535
Oil, waste and supplies	89
	$3,299

NON-CONDENSING.

Coal at $5.00 per ton	$2,050
Fixed charges at 11 per cent.	650
Attendance	520
Oil, waste and supplies	86
	$3,306

These figures show that while the initial cost of the condensing plant is 11 per cent. higher than that of the non-condensing, the gain in economy of operation is very slight, as with an engine of but 75 H.P. the proportion of steam used in driving the auxiliaries is comparatively large. For this reason it is not customary to operate power plants of less than 200 to 300 H.P. condensing.

It is, of course, a further question as to whether, at any rate in England, where municipalities and private companies are laying such complete networks of electric power supply systems, the small unit steam power plant is not already doomed, and it would be an interesting thing if Mr. Snow could, at some future time, supplement his recent valuable article with particulars of initial working costs of electric power installations of the same B.H.P. as the sets he has quoted, and operated from an outside power source of large magnitude.

NEW PATENTS APPLIED FOR, 1908.

Compiled expressly for this journal by W. P. Thompson & Co., Electrical Patent Agents, 322, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

18,192. "Improvements in induction coils." R. F. Hall. August 31st.

18,204. "Improvement connected with the mouthpiece of telephones." A. Lewis and I. Lewis. August 31st.

18,216. "Improvements in the surface contact system of electric traction." The S. P. (Suchostawer Patents) Syndicate, Ltd., and H. M. Sayers. August 31st. (Complete.)

18,220. "Electro-plating apparatus." G. A. Lutz. August 31st. (Complete.)

18,222. "Improvements relating to fixing and supporting overhead electric traction conductors in tunnels and the like." Siemens Bros. Dynamo Works, Ltd. (Siemens-Schuckertwerke G.m.b.H., Germany.) August 31st. (Complete.)

18,233. "New system of fitting incandescent electric lamps." G. Weissmann. (Date applied for under Sec. 91 of the Act, January 10th, 1908, being date of application in France.) August 31st. (Complete.)

18,246. "Improvements in electroplating and like processes." H. Hutton and R. S. Hutton. August 31st.

18,275. "Improvements in regenerative systems of control for electric motors." W. Cooper. (Date applied for under Sec. 91 of the Act, September 3rd, 1907, being date of application in United States.) August 31st. (Complete.)

18,277. "Improvements in and relating to thermo-electric piles." A. Rittershausen. August 31st.

18,278. "Improvements in the process of sealing the filament carrier into the bulb of electric incandescent lamps." J. Kremenezky. August 31st. (Complete.)

18,326. "Electrical sounding fork vibrator." I. Muller. September 1st.

18,330. "Improvements in equalising devices for alternating-current circuits." W. Cooper. (Date applied for under Sec. 91 of the Act, September 3rd, 1907, being date of application in the United States.) September 1st. (Complete.)

18,331. "Improvements in systems of operation for alternating-current motors and generators." W. Cooper. (Date applied for under Sec. 91 of the Act, September 3rd, 1907, being date of application in the United States.) September 1st. (Complete.)

18,342. "Improvements connected with electric glow lamps." G. Davis. (Application for Patent of Addition to No. 29,620/1906.) September 1st.

18,359. "Circuit tester." W. Roos. September 1st. (Complete.)

18,372. "Improvements in and relating to alternating-current dynamo-electric machines of the commutator type." Allgemeine Elektricitats Ges. (Date applied for under Sec. 91 of the Act, September 21st, 1907, being date of application in Germany.) September 1st. (Complete.)

18,408. "Improved apparatus for suspending and varying the position of electric and other lights." G. Thomson. September 2nd.

18,429. "Improvements in means or apparatus for electrically synchronising clocks." V. R. Brandon and A. G. Hellyar. September 2nd.

18,430. "Improvements in apparatus for producing high-frequency electric oscillations more particularly applicable to wireless signalling." R. A. Fessenden. (Date applied for under Sec. 91 of the Act, September 16th, 1907, being date of application in United States.) September 2nd. (Complete.)

18,457. "Improvements in telegraph keys." J. Z. Tucker, L. V. Tucker, F. J. Hudson, B. J. Cissell, E. J. Cissell and N. J. Rankin. September 2nd. (Complete.)

18,458. "Improvements in and relating to electric heating devices." British Thomson-Houston Co., Ltd. (General Electric Co., United States.) September 2nd. (Complete.)

18,460. "Improvements in and relating to commutating devices for dynamo-electric machines." British Thomson-Houston Co., Ltd. (Allgemeine Elektricitats-Ges., Germany.) September 2nd. (Complete.)

18,461. "Improvements in and relating to commutating poles for dynamo-electric machines." British Thomson-Houston Co., Ltd. (General Electric Co., United States.) September 2nd. (Application for Patent of Addition to No. 5,741/1907.) (Complete.)

18,487 "Improvements in or relating to electrical apparatus for forming letters and the like." C. Vaccaneo. September 3rd. (Complete.)

18,509. "Improvements in and relating to mariners' compasses." L. W. P. Chetwynd, Kelvin & James White, Ltd, and F. W. Clark. September 3rd.

18,510. "Attachment for mariners' compasses." L. W. P. Chetwynd, Kelvin & James White, Ltd., and F. W. Clark. September 3rd.

18,513. "Improvements relating to electric induction furnaces." Rochling 'sche Eisen und Stahlwerke Ges.m.b.H. and W. Rodenhauser. (Date applied for under Sec. 91 of the Act, February 26th, 1908, being date of application in Germany.) September 3rd. (Complete.)

18,518. "Improvements in printing telegraphs." E. C. R. Marks. (Burlingame Telegraphing Typewriter Co., United States.) September 3rd. (Complete.)

18,581. "Single-phase induction motor." G. Bestetti and F. Spinelli. September 3rd. (Complete.)

18,579. "System of governing low-pressure turbines driving generators coupled in parallel with others of the same kind." A. Rateau. (Date applied for under Sec. 91 of the Act, September 16th, 1907, being date of application in Belgium.) September 4th. (Complete.)

18,619. "Improvements in electric protective devices of the type known as lightning arresters." British Thomson-Houston Co., Ltd. (General Electric Co., United States.) September 4th. (Complete.)

18,620. "Improvements in switches." Wade & Jones, Ltd., and F. R. Wade. September 4th.

18,621. "Improvements relating to ignition devices for internal combustion engines." H. N. Bickerton, P. W. Robson, and The National Gas Engine Co., Ltd. September 4th.

18,622. "Improvements in electric starting switches using liquid resistance." The Sandycroft Foundry Co., Ltd., and T. M. Dutton. September 4th.

18,628. "Improvements in and relating to electric ignition appliances." A. M. Low. September 5th.

18,653. "Electric furnace for the continuous extraction of zinc from its ores" E. F. Cote and P. R. Pierron. (Date applied for under Sec. 91 of the Act, February 12th, 1908, being date of application in France.) (Application for Patent of Addition to No. 5,100/07.) September 5th. (Complete.)

PUBLISHED SPECIFICATIONS.

Copies of any of these Specifications may be obtained of Messrs. W. P. Thompson & Co., 322, High Holborn, W.C., and at Liverpool and Bradford; price, post free, 9d. (in stamps).

1907.

Method of and Means for Producing Ignition of Explosive Mixtures in Explosion Motors. M. Delage and P. Woog. 10,855. May 9th.

Speed Control of Bodies Driven by Alternating-Current Electric Motors. H. A. Mavor, W. B. Hird and Mavor & Coulson, Ltd. 11,183. May 13th.

Methods of Electrical Distribution. W. Fennell and W. P. Perry. 15,846. July 10th.

Automatic Telephone Exchanges. Siemens Bros. & Co. (Siemens & Halske Akt. Ges.) 18,168. August 10th.

Electrolytic Processes for Covering Silver Plated Surfaces of Glasses or Mirrors with a Protective Metal Layer and Apparatus Therefor. J. H. Monge and C. Arzano. 18,210. August 12th.

Electrodes for Storage Batteries. W. Fennell and W. P. Perry. 18,348. August 14th.

Electric Auto-Musical Instruments. T. E. R. Phillips. 18,537. August 16th.

Protective Devices for Electric Systems. British Thomson-Houston Co. (Allgemeine Elektricitäts Ges., Germany.) 18,582. August 16th.

Incandescent Electric Lamps. T. W. Lowden. 18,688. August 19th.

Manufacture of Iron or Steel by the Open Hearth Process or Electrical Furnaces. J. Flohr. 19,348. August 28th.

Sparking Coils for Internal-Combustion Engines. C. A. Vandervell. 20,508. September 14th.

Alternating-Current Machines of the Commutator Type, having Cross Fields and Commutating Coils. Allgemeine Elektricitäts Ges. 20,867. September 19th. (Date applied for under International Convention, September 20th, 1906.)

Systems of Electric Motor Control. British Thomson-Houston Co. (General Electric Co., United States.) 22,405. October 10th.

Control of Electric Motors. Allgemeine Elektricitäts Ges. 22,481. October 11th. (Date applied for under International Convention, October 13th, 1906.)

Electric Transformers. H. W. Turner. 23,418. October 23rd. (Post-dated January 23rd, 1908.)

Manufacture of Electric Incandescence Lamps. E. A. Gimingham. 23,786. October 28th.

Protective Devices for Electric Circuits. P. Pooley and W. R. Macdonald. 24,589. November 6th.

Alternating-Current Dynamo-Electric Machines. British Thomson-Houston Co. (General Electric Co., United States.) 24,808. November 8th.

Systems of Generating and Distributing Electric Current. British Thomson-Houston Co. (General Electric Co., United States.) 25,115. November 12th.

Electric Ignition in Combustion Engines. E. Ashton and G. H. Ashton. 25,148. November 13th.

Electrical Protective Devices of the Type known as Lightning Arresters. British Thomson-Houston Co. (General Electric Co., United States.) 27,225. December 9th.

Voltage Regulated System of Electrically Lighting and Heating Vehicles. H. Grob. 14,059 June 18th. (Date applied for under International Convention, July 6th, 1906.)

Boxes or Cases for Thermal-Electric Contact Making Devices. F. E. Ryall. 18,937. August 22nd.

Tremblers for Electric Sparking Apparatus. Marconi's Wireless Telegraph Co. and C. Mitchell. 19,085. August 24th.

Dynamo-Electric Machines. J. W. Burleigh. 19,174. August 25th.

Electric Make-and-Break Devices for Magneto Ignition in Internal-Combustion Engines. A. Lutz. 20,261. September 11th.

Electrode for Secondary Batteries. E. Heymann. 20,491. September 14th.

Means and Apparatus for Regulating the Ignition in Internal-Combustion Engines. S. Sanders and J. W. Dean. 21,017. September 21st.

Magneto-Electric Machines for Ignition Purposes. C. A. Vandervell and F. I. Hoffman. 21,273. September 25th.

Electric Furnace for the Continuous Extraction of Zinc from its Ores. E. F. Cote and P. R. Pierron. 22,283. October 9th.

Magnetic Separators. G. T. Meek. 22,523. October 12th.

Optical Lanterns and the Regulation and Control of Light-Producing Agents, Electric Arcs, Limelights or the like, Used in Connection Therewith and Apparatus Therefor. G. Robson. 23,818. October 29th.

Device for Separating Iron Particles from Chaff and the like by means of Magnets. J. Hagmüller. 26,055. November 25th.

Tremblers for Induction Coils. J. Guenet. 27,375. December 11th.

Springs Particularly Applicable to the Manufacture of Electric Incandescence Lamps. E. A. Gimingham. 27,543. December 13th.

1908.

Electric Power Transmission Particularly Applicable to Motor Vehicles. F. Porsche. 7,006. March 30th.

Dynamo-Electric Machines. J. E. Noeggerath. 8,415. April 15th. (Date applied for under International Convention, April 25th, 1907.)

Contrivance and Apparatus for Storing the Heat Furnished by a Source of Electricity. Soc Anon. l'Electricite Moderne. 8,996. April 24th. (Date applied for under International Convention, April 6th, 1908.)

Sparking or Ignition Plugs for Use in Gas or Petrol Engines and the like, for Motor Vehicles and other Purposes. J. A. Mason. 9,092. April 27th.

Condensers of the Leyden Jar Type. S. Eisenstein. 10,023. May 8th.

Metal Armouring for Electric Conductors. F. Kuhlo. 13,489. June 25th.

Dynamos. D. Derain. 2,195. January 31st. (Date applied for under International Convention, February 6th, 1907.)

Telegraph Poles. F. H. Tidnam. 4,030. February 22nd. (Date applied for under International Convention, July 9th, 1907.)

Electric Arc Lamps. C. A. Taylor and E. R. A. Broom, trading as the New Arc Light Co. 4,568. February 28th.

Electro-Mechanical Transmission Systems for Automobiles and the like. H. Pieper. 5,159. March 7th.

Electric Couplings for Fire and other Hose Containing Conductors Embedded Therein. H. Groswith. 6,178. March 19th.

Trolleys or Collectors for Electricity. P. C. Bliven. 6,450. March 27th.

Field Magnets for Dynamo-Electric Machines. A. C. Brookes. (Cushman Electric Co., United States.) 7,571. April 6th.

Electrical Railways, Tramways and the like. C. von Gizinsky, W. McClure and E. Wiesner. 10,118. May 9th.

Carbon Brush-Holders for Magneto-Electric Igniters. Firm of R. Bosch. 14,698. July 10th. (Date applied for under International Convention, April 21st, 1908.)

Electrolytic Processes for Covering Silver Plated Surfaces of Glasses or Mirrors with a Protective Metal Layer and Apparatus Therefor. J. H. Monge and A. Arsano. 16,588. August 5th. (Date applied for under Rule 13, August 12th, 1907.)

Electrolytic Processes for Covering Silver Plated Surfaces of Glasses or Mirrors with a Protective Metal Layer and Apparatus Therefor. J. H. Monge and A. Arsano. 16,589. August 5th. (Date applied for under Rule 13, August 12th, 1907.)

Operating Mechanism for Railway and Tramway Points and Switches. A. B. Allen. 1,721. January 24th.

Electrically and Mechanically Operated Steam and like Whistles. B. J. B. Mills. (The Signal and Control Co., United States.) 2,127. January 30th.

Apparatus for Use in the Electrolytic Manufacture of Metallic Foil or Leaf. S. O. Cowper-Coles. 4,278. February 25th.

Method of and Apparatus for Compensating Friction of Brushes or like Rubbing Parts in Motor Meters or other Apparatus. G. E. J. O'Keenan. 4,274. February 25th.

Electric Tramway or like Points. E. Veevers and G. H. Butterworth. 6,721. March 26th.